Climate change acts as tools for climate policy integration?

A comparative analysis of Sweden and the United Kingdom

Master Thesis

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Submitted by: **Lea Pamperl**

Supervisor: Assoc. Prof. Mag. Dr. Reinhard Steurer
Institute of Forest, Environmental and Natural Resource Policy
Department of Economics and Social Sciences
University of Natural Resources and Life Sciences, Vienna

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Affidavit

I hereby declare that I am the sole author of this work. No assistance other than that which is permitted has been used. Ideas and quotes taken directly or indirectly from other sources are identified as such. This written work has not yet been submitted in any part.

Vienna, October 2019 _____

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Abstract

Climate change acts (CCAs) are framework laws that aim to facilitate climate change mitigation by setting emission targets, creating procedures for planning, reporting and monitoring as well as establishing independent advisory bodies. The United Kingdom Climate Change Act (UK CCA) from 2008 is considered to be a pioneering piece of legislation and potentially has served as a model for similar CCAs in other countries, e.g. Austria (2011), Iceland (2012), Denmark (2014), Finland (2015), Ireland (2015), Norway (2017) and Sweden (2017). Considering that the enactment of CCAs is a fairly new development, several CCAs have not yet been analyzed in great detail. This master thesis addresses this gap by providing a comparative analysis of the CCAs enacted in Sweden and the United Kingdom, with a particular focus on their potential to overcome the common challenge of facilitating climate policy across all sectors of government. First, the key design elements of both CCAs in terms of targets set, procedures for planning, reporting and monitoring foreseen, their degree of implementation as well as their legal bindingness and enforceability are analyzed separately. Subsequently, both cases are systematically compared using an analytical framework based on the concept of climate policy integration (CPI). Overall, the comparative analysis shows that the UK CCA seems better equipped to facilitate climate policy across sectors with regard to all key design elements. Nonetheless, both countries are currently off-track for meeting their emission targets. Taking into account that both CCAs do not foresee sanctioning mechanisms in case of non-compliance, procedural alternatives for holding governments accountable and bridging implementation gaps need to be established or strengthened.

Keywords: Climate change mitigation, climate policy integration, climate framework laws, Sweden, United Kingdom

Kurzfassung

Klimaschutzgesetze (KSG) sind Rahmengesetze, welche darauf abzielen, Klimaschutz voranzutreiben indem sie Emissionsziele festlegen, Prozesse für Planung, Berichtslegung und Monitoring etablieren, sowie die Einrichtung von unabhängigen Beratungsgremien vorsehen. Das KSG Großbritanniens aus dem Jahr 2008 wird als Vorreitergesetzgebung angesehen und diente potentiell als Vorbild für ähnliche KSG in anderen Ländern, z.B. Österreich (2011), Island (2012), Dänemark (2014), Finnland (2015), Irland (2015), Norwegen (2017) und Schweden (2017). Nachdem die Verabschiedung von KSG eine eher neue Entwicklung ist, wurden einige KSG bisher noch nicht im Detail analysiert. Diese Masterarbeit adressiert diese Forschungslücke, indem eine vergleichende Analyse der KSG in Schweden und Großbritannien durchgeführt wird. Dabei liegt der Fokus auf dem Potential der KSG die gemeinsame Herausforderung der Integration von Klimapolitik in verschiedene Sektoren zu überwinden. Zuerst werden Kernelemente beider KSG in Hinblick auf Emissionsziele, Prozesse für Planung, Berichtslegung und Monitoring, deren Umsetzung sowie die rechtliche Verbindlichkeit und Durchsetzbarkeit getrennt analysiert. Danach werden die Gesetze beider Länder anhand eines Analyserahmens zum Konzept der Klimapolitikintegration miteinander verglichen. Die vergleichende Analyse zeigt, dass das KSG Großbritanniens über alle Kernelemente hinweg besser ausgestattet ist, um Klimapolitik in verschiedene Sektoren zu integrieren. Dennoch sind beide Länder aktuell nicht am richtigen Weg, um ihre Emissionsziele zu erreichen. Nachdem beide KSG keine Sanktionen für den Fall einer Nichteinhaltung vorsehen, sollten alternative Prozesse etabliert bzw. gestärkt werden, um Regierungen in die Pflicht zu nehmen und Umsetzungslücken zu schließen.

Schlagworte: Klimaschutz, Klimapolitikintegration, Klimarahmengesetze, Schweden, Großbritannien

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Abbreviations

ASC Adaptation Sub-Committee
CCA climate change act
CCC Committee on Climate Change
CDM Clean Development Mechanism
CHP combined heat and power
CPC Climate Policy Council
CPCEO Cross-Party Committee on Environmental Objectives
CPI climate policy integration
DBEIS Department for Business, Energy and Industrial Strategy
DECC Department of Energy and Climate Change
DEFRA Department of Environment, Food and Rural Affairs
EPI environmental policy integration
EQO Environmental Quality Objective
EU ETS European Union Emission Trading Scheme
F-gas fluorinated greenhouse gas
GHG greenhouse gas
GPD gross domestic product
HYBRIT Hydrogen Breakthrough Ironmaking Technology
IPCC Intergovernmental Panel on Climate Change
JI Joint Implementation
KLIMP Climate Investment Program
LIP Local Investment Program
LULUCF land use, land use change and forestry
MP member of parliament
NMS national mitigation strategy
OECD Organization for Economic Cooperation and Development
SCA Swedish Climate Act
SEPA Swedish Environmental Protection Agency
UK CCA United Kingdom Climate Change Act

Chapter 1

Introduction

Climate change is often considered a wicked problem challenging policy makers because of its cross-cutting and long-term nature (Dupont, 2013). As a cross-cutting issue, effectively combatting climate change thus calls for climate policy efforts across all sectors of government (e.g. energy, transport, industry, housing and agriculture), each of which has differing priorities and actors with varying interests. In addition, long-term conditions are necessary to successfully facilitate a transition to a low-carbon as well as climate-resilient society. Short legislative periods, however, often put already made commitments on climate action at risk of being lowered or discarded after changes of governments.

As a complex problem affecting all sectors of government, climate change has led many European countries to develop multi-sectoral national mitigation strategies (NMSs) to coordinate sectoral policy-making. However, as Casado-Asensio and Steurer (2016) have shown in their comparative analysis of NMSs in the EU-15 group of countries, these non-binding policy strategies did not succeed in effectively facilitating mitigation and thereby reducing greenhouse gas (GHG) emissions. Failing NMSs possibly paved the way for a policy innovation of climate change acts (CCAs).

CCAs as legally binding instruments aim to commit present and future governments to prioritize climate policy compared to other policy areas and engage all sectors of government in climate change mitigation (in some cases also adaptation). Naturally, CCAs vary in their design from one country to another, although most contain common features such as emission targets, procedures for planning, reporting and monitoring as well as the establishment of an independent advisory body. The United Kingdom Climate Change Act (UK CCA) from 2008 is considered to be a pioneering piece of legislation and potentially has served as a model for similar CCAs in other countries, such as Austria (2011), Iceland (2012), Denmark (2014), Finland (2015), Ireland (2015), Norway (2017) and Sweden (2017) (Nash and Steurer, 2019). This recent legislative pattern in multiple countries suggests a tendency for policy diffusion originating from the UK CCA (Torney, 2017, 2019).

In light of these developments, this master thesis aims to systemically compare the UK CCA and the Swedish Climate Policy Framework[1]. The underlying research interest for this comparative analysis is to develop an understanding of how both CCAs potentially serve as tools to overcome the common challenge of facilitating climate policy across sectors. Both Sweden and the UK are often known for their ambitiousness on climate policy and are viewed as climate leaders by many other countries (Boasson, 2013). In this context, it is worth researching the experiences of the UK and Sweden in a comparative setting, since this may eventually allow for drawing lessons on favorable conditions for CCAs to be able to change sectoral policy-making.

Considering that the enactment of CCAs is a fairly new development, several of the CCAs have not yet been analyzed in great detail. This especially applies to the Swedish Climate Policy Framework, which has only been presented in March 2017 (Prop. 2016/17:146). Thus far only the UK CCA has been researched extensively by numerous scholars (e.g. Averchenkova et al., 2018; Benson and Lorenzoni, 2014; Carter, 2014; Carter and Childs, 2017; Carter and Jacobs, 2013; Church, 2015, 2016; Fankhauser et al., 2018; Farstad et al., 2018; Gillard, 2016; Hill, 2009; Lockwood, 2013; Lorenzoni and Benson, 2014; Macrory, 2014; McGregor et al., 2012; Muinzer, 2018; Reid, 2012; Rutter et al., 2012; Scheer and Höppner, 2010; Weeks, 2017). Furthermore, a comparison of the Irish CCA and the Finnish CCA was conducted by Torney, analyzing the extent of policy diffusion originating from the UK CCA (Torney, 2017, 2019). Additionally, the Finnish CCA has been analyzed regarding its legal implications and effectiveness (Kymenvaara, 2015; Pölönen, 2014; Utter, 2013). Moreover, Duwe et al. (2017) conducted a comparative study analyzing the effectiveness of multiple CCAs on the national, sub-national and city level in bringing about transformational change, which covers amongst others also the UK CCA and the Swedish Climate Policy Framework. In addition, Nash and Steurer (2019) compared seven European CCAs, analyzing the extent to which they are living policy processes or symbolic gestures. Although both comparative studies offer a sound overall assessment of multiple cases, the studies are far from being comprehensive regarding description and analysis of the individual cases. Finally, to date there is no in-depth analysis of any CCA with an explicit focus on its potential of facilitating climate policy across sectors. This master thesis addresses this gap by answering the following research questions:

[1]It is important to note that in Sweden, only general provisions for the government's work on climate policy as well as the establishment of a planning and reporting system are regulated by law, however, no provisions regarding emission targets or the creation and assigned evaluation activities of an independent advisory body are included in the legislative text. The latter two elements only form part of the overall Swedish Climate Policy Framework (Prop. 2016/17:146). The remainder of this thesis thus refers to the Swedish Climate Policy Framework when relating to the overall framework, including all of the elements listed above and not only the elements regulated by law.

Within-case: What are the key design elements of the Swedish Climate Policy Framework and the UK CCA?

- **What objectives do they set regarding climate policy?**
- **What procedures do they foresee for planning, reporting and monitoring of climate policy and to what degree have they been implemented?**
- **How legally binding are they? Are there any sanctions foreseen in case of non-compliance?**

Cross-case: What is the potential of the Swedish Climate Policy Framework compared to the UK CCA for facilitating climate policy across sectors?

To begin with, Chapter 2 elaborates on the methodology used in this thesis. Thereafter, the analytical framework for the comparative analysis based on the concept of climate policy integration (CPI) and factors influencing effectiveness of CCAs is presented in Chapter 3. In the beginning of Chapter 4 and 5 relevant national circumstances on climate strategy and objectives, energy mix and GHG emission developments, climate policy developments as well as institutional arrangements are presented for each case respectively. The remaining part of both chapters is then dedicated to analyzing the key design elements of the UK CCA and Swedish Climate Policy Framework, which further allows for answering the within-case research question separately for both cases. Subsequently, Chapter 6 deals with the comparative analysis of both cases structured along the analytical framework presented in Chapter 3. In doing so, Chapter 6 presents evidence relevant for answering the cross-case research question. Finally, Chapter 7 answers the cross-case research question based on what has been elaborated, draws general conclusions regarding strengths and limitations of CCAs and gives an outlook on potential improvements of CCAs as well as possible further research.

Chapter 2

Methodology

Building on the methodological work of Yin (2008), this thesis conducts a comparative analysis of the UK CCA and the Swedish Climate Policy Framework using case studies as a research method. The work at hand complies with a multiple-case design, in which both cases are initially analyzed separately and then systematically compared in a second step (Yin, 2008). According to Yin (2008, p 18), a case study is an *"empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident"*. As multiple countries adopted CCAs in recent years, this policy innovation is clearly a contemporary phenomenon requiring an analysis in its real-life context in order to be covered comprehensively. Additionally, the fact that the investigator has little control over events indicates that case studies are the preferred method (Yin, 2008).

The case selection is primarily based on the research interest to analyze the experiences of two countries that are usually perceived as being front-runners regarding climate policy. In addition, several indications suggest a strong linkage between the two cases, insofar that the Swedish Climate Policy Framework has drawn on the model of the UK CCA, such as the extensive consideration of the UK CCA in background reports and policy proposals commissioned by the Swedish government (SOU 2016:21) or a workshop aiming at the exchange of practices regarding the UK CCA held at the Swedish Parliament House in Stockholm in June 2015 (Regeringskansliet, 2015). Nevertheless, the UK CCA has potentially served as a model for comparable CCAs in several other countries as well (e.g. Austria, Ireland, Finland, Denmark). It should therefore be noted that the choice for the Swedish case is also based on personal interest and practical considerations, such as existing Swedish language skills and extensive data availability.

At first, gaining a general overview on the latest developments regarding CCAs as well as the current state of research on the issue was essential in order to specify and adopt the earlier outlined research questions. For this, an initial secondary data

collection was conducted via a basic keyword search in research databases and media coverage. As a result it became clear that studying CCAs and investigating their potential for facilitating climate policy across sectors called for reviewing academic literature on the concept of CPI. The following literature review on the concept of CPI was conducted using a snowballing approach (Wytrzens et al., 2009). The next step was creating a structure for the case analysis, which enables a systematic comparison of both cases. Building on the work of Casado-Asensio and Steurer (2016), who assessed the empirical reality of NMSs against the ideal-type notion of integrated strategies, the idea of similarly structuring the comparative analysis in the scope of this thesis along factors influencing effectiveness emerged. Subsequently, the analytical framework was formed based on the concept of CPI and complementing it with factors influencing the effectiveness of CCAs, with regard to the latter building largely on the work of Duwe et al. (2017) and Rüdinger et al. (2018). Before diving into the actual case analysis, relevant background on national circumstances for Sweden and the UK were examined in order to better understand climate strategies and objectives, energy mix and GHG emission developments, climate policy developments as well as institutional arrangements of both countries. Finally, the stage was set for conducting a thorough desk study of relevant secondary sources providing insights on the key design elements of the UK CCA and the Swedish Climate Policy Framework. For this, information and data was mostly gathered from strategy papers, legislative documents and policy documents issued by national governments and other public agencies as well as reports from civil society groups and media coverage. Regarding the UK CCA, which was adopted almost ten years ago, relevant academic literature was reviewed as well, which has not been the case for the only recently adopted Swedish Climate Policy Framework since there are no scholarly works available to date.

Chapter 3

Analytical framework

This chapter introduces the analytical framework for the comparative analysis in the scope of this thesis, building on the concept of CPI as well as factors influencing the effectiveness of CCAs. Subsequently, this analytical framework allows for a systematic analysis of the UK CCA's and the Swedish Climate Policy Framework's potential for facilitating climate policy across sectors in Chapter 6 and in doing so providing analytical evidence for answering the cross-case research question.

Effectively combatting climate change as a cross-cutting issue calls for climate policy efforts across all sectors of government (e.g. energy, transport, industry, housing and agriculture). In this context, CPI can be understood as the integration of climate-related concerns into other policy domains (Dupont, 2013). CPI can both entail overall measures for policy coordination, as well as concrete climate policy measures in sectors which usually deal with issues other than climate change (Steurer and Clar, 2014).

As climate policy has traditionally been part of the environmental policy field, CPI is rooted in the literature on environmental policy integration (EPI) (Lafferty and Hovden, 2003). According to Adelle and Russel (2013), the concept of CPI can be analyzed, similarly to its "mother concept" EPI (Jordan and Lenschow, 2010), across three different dimensions: a normative, a governance-oriented and an output/outcome-oriented dimension. Normatively, CPI calls for integrating climate-related concerns into different sector policies that are relevant for combatting climate change but usually have other sector-specific priorities. The governance-oriented dimension of CPI deals with the actors and coordination processes to meet the normative postulate by minimizing trade-offs and maximizing synergies between climate policy aims and sector policy aims. Ultimately, the output/outcome-oriented dimension of CPI covers the results and effects of the normative and governance-oriented dimensions of CPI. While CPI outputs comprise all kinds of climate policies adopted horizontally across sectors and vertically across levels of government, the main CPI outcome in case of mitigation are actual GHG emission cuts across sec-

tors, and in case of adaptation reduced vulnerability to climate impacts across sectors (Adelle and Russel, 2013). All three dimensions of CPI are taken into account to form the analytical framework for the comparative analysis of the UK CCA and the Swedish Climate Policy Framework. However, there is no particular focus on outcome-oriented aspects of CPI within the scope of this thesis, due to the difficulty of assessing cause-effect relationships in this regard. Building on the work of Nash and Steurer (2019), the three dimensions of CPI are linked to key design elements of CCAs. As for the normative dimension, the analysis focuses on emission reduction targets, while the governance-oriented dimension considers policy planning processes, and the output-oriented dimension looks at reporting and monitoring mechanisms as outputs concerned with assessing and improving the outcomes of climate policies.

As a next step, the chosen design elements are further complemented with factors influencing their effectiveness. In this regard, the analytical framework largely builds on the work of Duwe et al. (2017) and Rüdinger et al. (2018). Duwe et al. (2017) conducted a first comparative study analyzing the effectiveness of multiple national, sub-national and city level CCAs in bringing about transformational change. Based on the insights and lessons learned from this comparative study, Rüdinger et al. (2018) subsequently provided a more detailed assessment of factors influencing the effectiveness of CCAs. Most of these influencing factors provided by Rüdinger et al. (2018) are included in the analytical framework of this thesis and matched with the above mentioned design elements (see Table 1). Deviations from the work of Rüdinger et al. (2018) are explained at the end of the section. In general, it is important to note that drawing these influencing factors largely from existing literature could potentially entail limitations regarding validity and comprehensiveness as well as leave possible blind spots in the assessment. However, developing a new set of influencing factors as part of the analysis is beyond the scope of this thesis.

In the following, the chosen factors influencing the effectiveness of CCAs are presented in closer detail. First, the effectiveness of emission targets is determined by the existence of a clear long-term target enabling to drive a low-carbon transition over time. However, the definition of interim targets is also of great importance to establish a decarbonization pathway coherent with the long-term target. Moreover, the legal bindingness of targets is crucial to promote stability and hold present and future governments accountable. As for the scope of the targets, it is paramount that all emission sources are covered in order to allow for decarbonization of the economy as a whole. Additionally, it is important that emission targets relating to climate neutrality provide a clear definition of the relative importance attributed to domestic reductions, international offsets and carbon sinks Rüdinger et al. (2018). As a point of reference for the level of ambition regarding emission targets, the anal-

Table 1: Analytical framework for comparative analysis (Adapted from Duwe et al., 2017; Rüdinger et al., 2018)

CPI dimension	**Design elements**	**Factors influencing the effectiveness of CCAs**
Normative postulate	Emission targets	Statutory long-term and interim targets defined
		Emissions from all sources covered and climate neutrality defined
		Level of ambition in line with the Paris Agreement's well below 2°C and striving for 1.5°C target
Process of governing	Policy planning	Statutory policy planning at regular intervals
		Plans contain detailed, specific and feasible policy packages
		Compliance procedures foreseen
Policy output	Reporting and monitoring	Statutory government reporting at regular intervals
		Statutory progress monitoring and evaluation by independent advisory bodies at regular intervals
		Statutory mandate for parliamentary oversight

ysis looks at the compatibility with the Paris Agreement[2]. Although the UK CCA (2008) precedes the Paris Agreement (2015) and thus was developed under different circumstances, the analysis nonetheless uses the ambition of the Paris Agreement as a benchmark for comparability.

Second, the effectiveness of processes for policy planning is determined by the establishment of a statutory duty for governments to present policy plans at regular intervals. Moreover, these plans shall contain detailed, specific as well as feasible policy packages to ensure the achievement of the targets and shall not be used as strategic planning tools describing an "ideal" pathway to the low-carbon future only. Additionally, the effectiveness of processes for policy planning clearly depends on the

[2]The Paris Agreement aims for limiting global temperature rise well below 2°C and strives for 1.5°C. In order to reach this long-term temperature goal, net-zero emissions shall be reached globally in the second half of the century (United Nations, 2015).

existence of procedures to solve implementation gaps in case emission targets are not reached (Rüdinger et al., 2018).

Third, the effectiveness of reporting mechanisms is determined by the establishment of a statutory duty for governments to report on progress at regular intervals in order to foster accountability and transparency. Similarly, statutory monitoring at regular intervals is crucial in order to keep track of progress towards achieving emission targets and strengthen compliance. The credibility of such monitoring processes largely depends on whether these are performed by independent advisory bodies or government institutions themselves. The impact and added value of independent advisory bodies clearly depends on the strength of their mandate as well as the dedicated resources and capacities in order to fulfill their function. Ultimately, the role of parliamentary oversight is crucial as well. As such, providing the parliament with a statutory mandate to supervise reporting and monitoring processes allows for increased government accountability compared to a merely consultative role of parliament (Rüdinger et al., 2018).

As for deviations from the work of Rüdinger et al. (2018), two influencing factors are left out entirely, namely the extent of support from political decision-makers and stakeholders as well as the inclusion of procedures that enable the revision of CCAs. The former is not included as the secondary data collection within the scope of this thesis does not allow for a thorough analysis in this regard. The latter is left out as it appears debatable whether the adaptability of CCAs really fosters their effectiveness. As the UK case shows, adaptability can also entail weakening of the CCA implementation (Carter, 2014). Moreover, the legal bindingness of CCAs and their individual elements as an influencing factor is not listed separately but integrated with other factors where applicable, e.g. "statutory long-term and interim targets defined" or "statutory policy planning at regular intervals". Additionally, Rüdinger et al. (2018) emphasize the creation of dedicated institutions as an overarching aspect influencing the effectiveness of CCAs. This aspect is only partially integrated, namely where relating to independent advisory bodies, but left out with regard to governmental institutions tasked to ensure policy co-ordination as well as institutions tasked to ensure a regular involvement of stakeholder groups, as both the UK CCA and the Swedish Climate Policy Framework do not foresee the creation of such institutions.

Chapter 4

Sweden

This chapter analyzes the key design elements of the Swedish Climate Policy Framework, thereby providing descriptive evidence for answering the within-case research question for the Swedish case: What are the key design elements of the Swedish Climate Policy Framework in terms of targets set, procedures for planning, reporting and monitoring foreseen, their degree of implementation, as well as their legal bindingness and enforceability?

4.1 Background

This section presents background on national circumstances regarding climate strategy and objectives, energy mix and GHG emission developments, climate policy developments as well as institutional arrangements for the Swedish case. Subsequently, this allows for a discussion of the findings of the Swedish case study while taking into account relevant national circumstances in Chapter 6.

4.1.1 Climate strategy and objectives

Already in the early 1990s, the political discourse in Sweden was characterized by the idea of prioritizing environmental issues compared to other policy areas, and political action in this context has been built on strong cross-party support for environmental issues ever since. In 1996, the vision of a “Green People’s Home” was presented by the Social Democratic Party, inspired by the historic vision of creating a welfare state, referred to at the time as “People’s Home”, which thus called for a reorganization of society along ecological lines (Matti, 2016). Subsequently, Sweden started to develop its climate policy based on one of the 16 Environmental Quality Objective (EQO), namely "Reduced Climate Impact", which has been originally adopted by the Swedish parliament in 1999 (Government Offices of Sweden, 2017c). Together with 15 other EQOs, as well as the so-called "Generation Goal", it forms the EQO system, which is not legally binding but provides long-term strategic orientation for Sweden’s environmental policy (OECD, 2014). The 16 EQOs describe the desired

state of the environment, whereas the "Generation Goal" defines the overall goal of handing over a society to the next generation in which the major environmental problems have been solved. As the name “Generation Goal“ indicates, this transition in society shall be reached within one generation and the year 2020 was thus chosen as deadline for all EQOs, except for the climate objective, for which a deadline was set to 2050. The "Reduced Climate Impact" objective signifies that atmospheric concentrations of GHGs must be stabilized at a level that will prevent dangerous anthropogenic interference with the climate system. Additionally, it specifies that both Sweden as well as other countries must take responsibility to reach this goal (SEPA, 2019a).

In 2009, Sweden’s "Integrated Climate and Energy Policy", originating from two government bills (Prop. 2008/09:162 focusing on climate and Prop. 2008/09:163 focusing on energy), added further specifications and a milestone target to the "Reduced Climate Impact" objective, as well as a vision to reach net-zero emissions by 2050[3]. The specifications of the “Reduced Climate Impact” objective entail a temperature target as well as a concentration target. The temperature target aims to limit the increase in global average temperature to no more than 2°C above pre-industrial levels. From this temperature target, the concentration target was derived, which aims to limit global atmospheric concentrations of GHG to 400 ppm CO_2-equivalent. Furthermore, a milestone target for emissions not covered by the European Union Emission Trading Scheme (EU ETS)[4] of 40% reduction by 2020 compared to 1990 levels was included (i.e. reduction of 18.6 million tonnes CO_2-equivalent, $MtCO_2e$) (Government Offices of Sweden, 2017c). To reach this target, up to one third of the reduction (i.e. 13.3 percentage points) may be achieved through flexible mechanisms[5], which means that only the remaining two thirds (i.e. 26.6 percentage points) of the 40% emission reduction actually has to happen within Swedish borders (Energimyndigheten, 2014). This national milestone target is clearly more ambitious than Sweden’s obligations under the Effort Sharing Decision implementing the 2020 Climate and Energy Package, which only foresee a 17% reduction by 2020 for emis-

[3]The term net-zero emissions signifies a balance between emission and removal of GHG from the atmosphere. In this context, removal of GHG refers to both natural processes such as carbon sinks as well as removal technologies such as carbon capture and storage (Fankhauser, 2018).

[4]The EU ETS puts a cap on emissions from covered installations. Companies are able to trade their emission allowances, however the cap is reduced over time. The system is currently in phase 3 (2013-2020) and covers the following sectors and greenhouse gases: CO_2 from power and heat generation, energy-intensive industry sectors and commercial aviation (only flights between airports located in the European Economic Area); nitrous oxide from production of nitric, adipic and glyoxylic acids and glyoxal; perfluorcarbons from aluminium production (EC, 2016).

[5]In order to meet their emission targets under the Kyoto Protocol, countries may use flexible mechanisms such as the Clean Development Mechanism (CDM) or Joint Implementation (JI). The CDM entails investment in emission reduction or removal enhancement projects in developing countries, while JI allows developed countries to realize emission reduction or removal enhancement projects in other developed countries (UNFCCC, 2018)

sions not covered by the EU ETS compared to 2005 levels (i.e. reduction of 7.1 $MtCO_2e$) (SEPA, 2017b). In this context it is noteworthy that Sweden has continuously been advocating for more ambitious EU-wide emission reduction targets (OECD, 2014).

The EQO system is monitored on an annual basis and further in-depth reviews are conducted once every parliamentary term (OECD, 2014). In this context, the 2019 annual report on the EQO system showed that the "Reduced Climate Impact" objective as well as many other EQOs have not yet been achieved and also cannot be achieved with existing and approved instruments and measures by 2020 or by 2050 in case of the climate objective (SEPA, 2019c). This leaves the EQO system as a rather ineffective tool to guide environmental policy action, which can be partly explained by its broad and imprecise goal formulations (Edvardsson, 2004). As an example, the EQO "Reduced Climate Impact" is formulated as a global objective, which does not specify Sweden's responsibilities in particular and thus only has limited value for facilitating domestic progress in emission reduction. Setting a national climate goal which cannot be attained by domestic actions alone but largely depends on international mitigation efforts can generally be questioned and does not give recognition to Sweden's efforts in domestic climate policy as well (OECD, 2014).

In response to the deficiencies of the EQO system, in July 2010, the Swedish government at that time decided to establish a committee of inquiry called Cross-Party Committee on Environmental Objectives (CPCEO). In general, the CPCEO's role is to advise the government on how the "Generation Goal" and the EQOs can be achieved and secure broad political consensus on environmental issues. The committee's overall remit runs until 2020, during which the government can task the CPCEO to bring forward proposals regarding prioritized policy areas (Regeringskansliet, 2010).

4.1.2 Energy mix and GHG emission developments

In comparison to other European countries, the energy intensity of Sweden's economy is relatively high, which is a result of the country's heavy industrial base (e.g. production of pulp and paper, minerals, iron and steel) as well as high heating demands around the year due to Sweden's relatively cold climate (OECD, 2014). Among the EU-28 member countries Sweden ranks as 7^{th} largest economy (The World Bank, 2018b), 27^{th} largest emitter per capita (Eurostat, 2018c) and 18^{th} largest emitter in absolute terms (Eurostat, 2018b). In comparison to its relatively low emissions per capita, Sweden has the EU's 3^{rd} highest energy use per capita (The World Bank, 2018a).

Total energy supplied in Sweden has experienced an upward trend since 1970, from 450 TWh to around 500-600 TWh from the mid-1990s onwards (Energimyndigheten,

2017b). Sweden's energy supply mix has changed substantially since the 1970s (see Figure 1), above all with a strong increase of nuclear power allowing for a sharp decrease of fossil fuels in the early 1980s. Since the mid-1980s, nuclear power has stabilized at approximately one third of Sweden's energy supply and, after a continuous decrease in the last decades, fossil fuels amounted to 28% in 2016 coming from 80% in 1970 (Energimyndigheten, 2017b). Sweden produces no oil, natural gas or coal and therefore depends on imports with respect to fossil fuels (Government Offices of Sweden, 2017c). Overall, Sweden's energy dependency amounted to 32% in 2016, which is the 5^{th} lowest level among EU-28 member countries (Eurostat, 2018a). Renewable energies began to play a more important role in the last decades as well, and allowed for the share of fossil fuels to further decrease. In particular, the use of biomass grew continuously during the last 40 years and amounted to 25% of Sweden's energy supply in 2016. The main users of energy from biomass are the district heating and industrial sectors, but a smaller share is also used as fuel in the transport sector (Energimyndigheten, 2017a).

In the early 1970s, Sweden's electricity production was dominated by hydropower and supplemented by oil-condensing power. The expansion of nuclear power and to some extent also hydropower until 1985 allowed to largely replace oil-fired power generation (see Figure 2) (Government Offices of Sweden, 2017c). In recent years, Sweden's electricity production has been largely dominated by hydropower and nuclear power, which covered 47% and 34% respectively in 2015. Wind power was able to increase its share significantly in recent years and covered 10% of the total electricity production in 2015. Biofuels and fossil-based production remained at a relatively constant level and covered 9% in 2015 (Energimyndigheten, 2017b). The trade balance for electricity has always been positive during the past few years, with net exports ranging roughly between 10 to 20 TWh per year (Energimyndigheten, 2017b).

At present, Sweden covers more than half of its energy use with renewable energy and has with 53.8% in 2016 by far the highest share of renewables compared to other EU member states (Eurostat, 2018d). The renewable energy sources contributing to this share are hydropower, wind power, by-products used in the paper and pulp industry and biofuels for district heating production (Government Offices of Sweden, 2017c).

Sweden's total domestic emissions in 2016 amounted to 52.9 $MtCO_2e$, which is a reduction of 25.8% compared to 1990 (-18.4 $MtCO_2e$). Most of these emission reductions have been achieved between 2003 and 2014, whereas since 2014 the emissions levels have remained largely unchanged. The emission developments outlined in Figure 3 clearly show that GHG emissions in Sweden are dominated by domestic transport and industry, amounting to 32.2% and 31.9% of total domestic emissions in

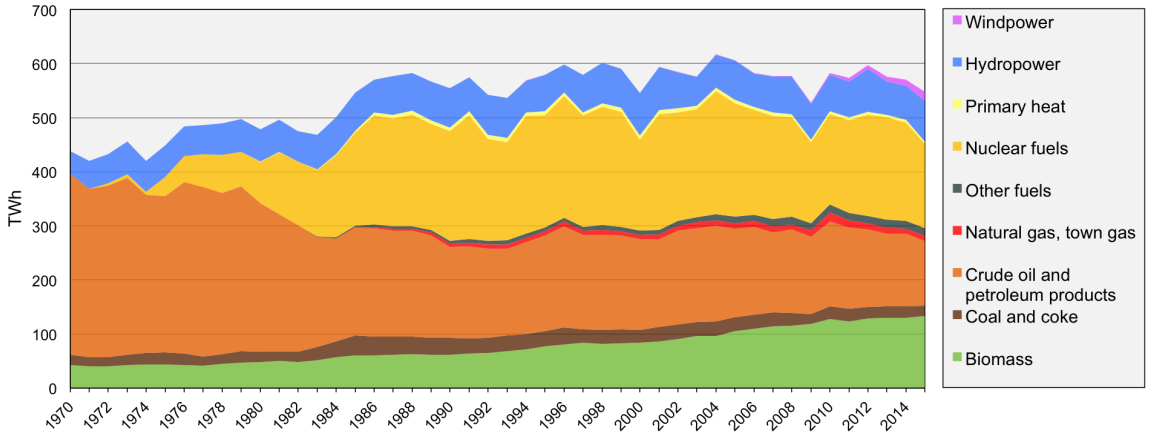

Figure 1: Sweden's total energy supply, 1970-2016, TWh (Data from Energimyndigheten, 2017b, Excel sheet 1.2)

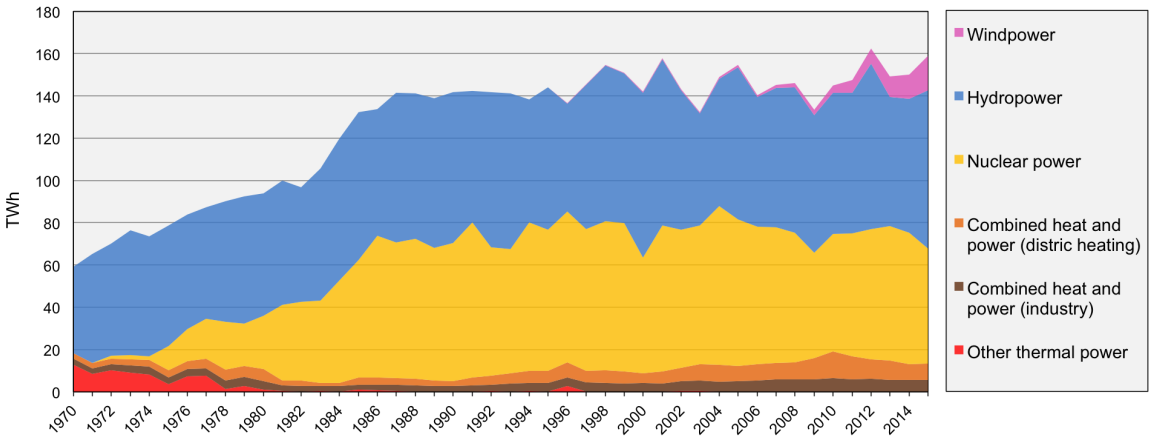

Figure 2: Sweden's total electricity production, 1970-2015, TWh (Data from Energimyndigheten, 2017b, Excel sheet 6.2)

2016 respectively (SEPA, 2018a). As for Sweden's industrial base, the most relevant sectors with respect to GHG emissions are iron and steel, refineries and minerals (SEPA, 2018d). The remaining emissions in 2016 stemmed from agriculture (13%), electricity and district heating (9%), heating of houses and premises (1.9%), working machinery (6.3%), solvent use and other product use (3.2%) as well as waste management (2.3%). Between 1990 and 2016, the greatest absolute emission reductions have been achieved in heating of houses and premises (-8.3 $MtCO_2e$, -89.1% emission reductions within the sector) as well as in industry (-3.8 $MtCO_2e$, -18.5% emission reductions within the sector). In addition, emissions have also been reduced in waste management (-2.4 $MtCO_2e$, -64.8% emission reductions within the sector), domestic transport (-2.6 $MtCO_2e$, -13.3% emission reductions within the sector), agriculture (-0.8 $MtCO_2e$, -10.3% emission reductions within the sector) as well as electricity

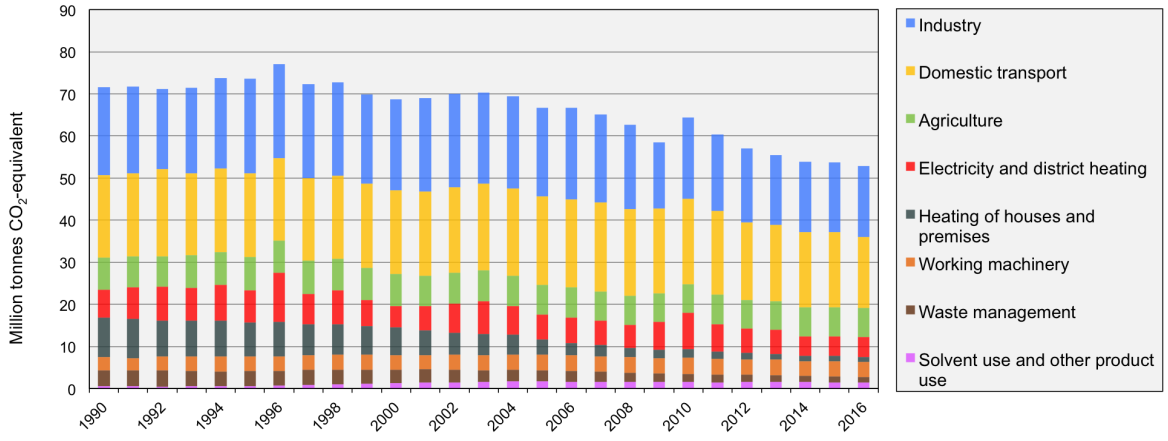

Figure 3: Sweden's total domestic GHG emissions excl. LULUCF, 1990-2016, 1,000 tonnes CO_2-equivalent (Data from SEPA, 2018a)

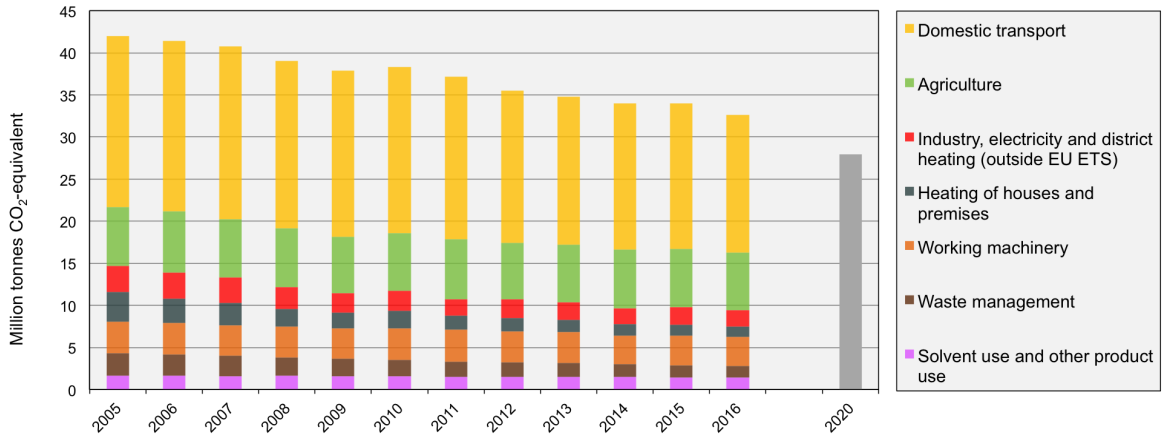

Figure 4: Sweden's GHG emissions in non-EU ETS sectors, 2005-2016, 1,000 tonnes CO_2-equivalent (Data from SEPA, 2017c)

and district heating (-1.7 $MtCO_2e$, -26.2% emission reduction within the sector). However, these reductions were less relevant compared to total emission reductions. In contrast, emissions from solvent use and other product use as well as emissions from working machinery have increased between 1990 and 2016 (+202.5% and +4.7% emission increase within the sectors respectively), although these increases are relatively small compared to total emission reductions (+1.1 $MtCO_2e$ and +0.1 $MtCO_2e$ respectively) (SEPA, 2018a). Overall, the Swedish National Audit Office highlights that Sweden's current GHG emission trajectory is not sufficient and far from reaching the country's long-term vision of net-zero emissions by 2050 (Swedish National Audit Office, 2014).

In 2016, 37% of Sweden's total emissions were covered by the EU ETS (equaling 20 $MtCO_2e$), which comprises at present ca. 750 facilities within industry and energy production. Between 2005 and 2016, emissions from Swedish facilities covered by the EU ETS decreased by 17% (from 24.6 $MtCO_2e$ in 2005 to 20.3 $MtCO_2e$ in 2016) (SEPA, 2018c, p 35). The remaining 63% of Sweden's total emissions were attributed to sectors not covered by the trading scheme (equaling 33 $MtCO_2e$). Between 1990 and 2016, Sweden was able to reduce its emissions in non-EU ETS sectors by 30% (see Figure 4), which corresponds to ca. 75% of the total emission reductions achieved in that period (SEPA, 2017a). In 2016, half of the emissions not covered by the EU ETS were related to the transport sector, while agriculture with a share of 21% and working machinery with a share of 11% also remain as challenges regarding further emission reductions (see Figure 4) (SEPA, 2017c). Sweden's national milestone target aiming at 40% emission reductions for non-EU ETS sectors by 2020 compared to 1990 levels has thus not yet been reached. However, the commitment to reach two thirds (i.e. 26.6 percentage points) of the target through domestic reductions has already been surpassed. It is very likely that the target can be met until 2020, as Sweden can either use the possibility to implement emission reductions through flexible mechanisms for the remaining 10 percentage points or further intensify measures to reduce domestic emissions (SEPA, 2019b).

In general, emission relevant developments in Sweden either go back to introduced policy measures affecting GHG emissions or are related to Sweden's economic development (e.g. economic stagnation, growing services sector in Swedish economy etc.). Regarding Sweden's economic development, it is noteworthy that the country is among the Organization for Economic Cooperation and Development (OECD) countries with the highest rate of decoupling of GHG emissions from gross domestic product (GPD) (see Figure 5) and experienced an increasing trend in absolute decoupling since the mid-1990s (see Figure 6) (OECD, 2014). However, Jiborn et al. (2018) emphasize that, when looking at the Swedish GHG emissions from a consumption-based perspective, no absolute but only relative decoupling has been achieved.

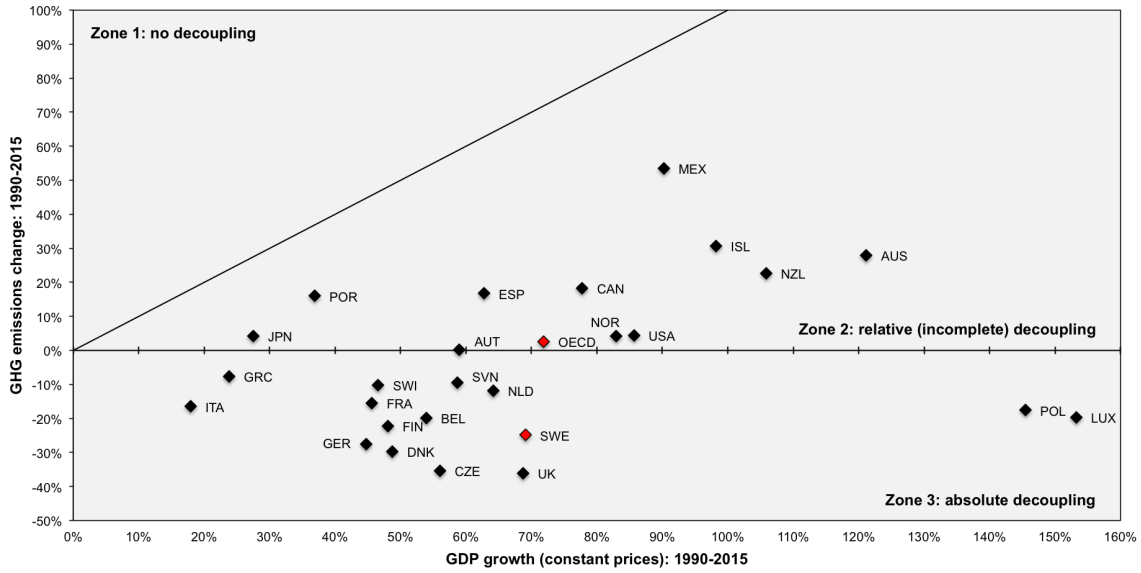

Figure 5: Decoupling of GHG emissions from GPD in Sweden compared to selected OECD countries, 1990-2015 (Data from OECD, 2018a,b)

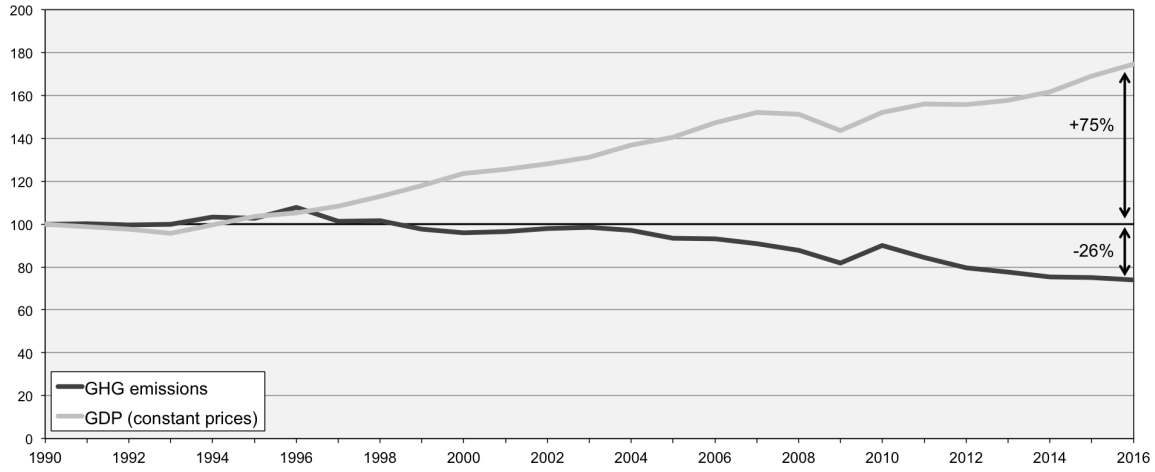

Figure 6: Decoupling of GHG emissions from GDP in Sweden, 1990-2016 (Data from OECD, 2018a,b)

4.1.3 Climate policy developments

In Sweden, policy measures affecting GHG emissions are primarily based on general economic instruments such as energy and CO_2 taxes as well as emission trading. In addition, these are supplemented with other market-based instruments such as technology procurement, renewable energy certificates and investment grants. Legislation such as prohibitions in the waste sector or planning legislation as well as information activities such as climate and energy advice or energy labeling for products have been introduced as well in order to reduce emissions. Overall, Sweden's

climate policy has continued to evolve towards stronger EU integration in recent years. In this context, EU-wide policy instruments such as the EU ETS, emission performance standards for new vehicles or energy performance certificates for buildings play an important role in the country's climate policy (Government Offices of Sweden, 2017c).

As for the Swedish system of energy taxation, an energy tax was first introduced for petrol and diesel in 1924 and 1937 respectively, while the scope was expanded to fuels for heating and electricity in 1957 (Government Offices of Sweden, 2017c). Energy tax levels depend on the energy content of the fuel as well as on the sector in which the fuel is used (Government Offices of Sweden, 2017c; OECD, 2018c). In 1991, the energy tax system was reformed to include the CO_2 tax, which is based on the fossil carbon content of the fuel, while simultaneously lowering the energy tax level by 50% (Friberg, 2008). The CO_2 tax has been raised in several steps since it was first implemented, i.e. from 27 Euros per tonne CO_2 in 1991 to 110 Euros per tonne CO_2 in 2019 (Jamet, 2011; SEPA, 2019e). After the introduction of the EU ETS, trading sectors successfully argued against double regulation and thus became exempt from the CO_2 tax (Friberg, 2008). In addition, industry not covered by the EU ETS as well as agriculture were also subject to lower CO_2 tax levels. However, in recent years CO_2 tax levels were increased until tax reductions were completely abolished in 2018 for both sectors. With regard to industry not covered by the EU ETS, earlier reductions from CO_2 tax were justified by the risk of carbon leakage (SEPA, 2019e). As for energy taxation, tax levels have changed throughout the years, and tax reductions again exist for industry and agriculture, while the residential and service sectors are subject to higher tax levels (Friberg, 2008). Fuels used to generate electricity are exempt from both energy and CO_2 taxes, although the electricity use itself is subject to an energy tax (Government Offices of Sweden, 2017c). Furthermore, biofuels used for heat production are exempt from energy taxation. In addition, the CO_2 tax does not generally apply for biofuels since the tax is based on the fossil carbon content of the fuel. As for the transport sector, reductions from energy taxation for biofuels varies between different kinds of biofuels (SEPA, 2019e).

Moreover, Sweden's cross-sector program for local climate investment in sectors outside the EU ETS is another cornerstone of the country's climate policy. The first program was called Local Investment Program (LIP) running from 1998 to 2002, which was then succeeded by the Climate Investment Program (KLIMP) running from 2003 to 2008 and now is followed by the Climate Leap Program introduced in 2015 (Friberg, 2008; Government Offices of Sweden, 2017c). In addition, the Environmental Code and the Planning and Building Act are further cross-sector instruments affecting GHG emissions. The Environmental Code was compiled in 1999 from existing legislation and encompasses general rules to be considered in all activities and measures affecting the environment. As such, GHG emissions are included in the

permit assessment procedure and the Environmental Code also includes obligations on the use of best available technologies. Since 2011, the Planning and Building Act introduces requirements for the consideration of environmental and climate issues of planning. Furthermore, since 2015 the Fossil-Free Sweden initiative provides a platform for dialogue and cooperation on climate action between key actors of society and the government (Government Offices of Sweden, 2017c). Besides these cross-sectoral policy measures, further important climate-related policies in respective sectors are described in the following.

With regard to the electricity and district heating sector, the electricity certificate system was introduced in 2003 as the main instrument to support electricity production from renewable sources. Electricity producers are required to acquire certificates equivalent to a certain share of their electricity production (quota), creating a demand, while producers of electricity from renewable sources receive certificates, creating a supply. The price of the certificates is influenced by this supply and demand and subsequently depends on the size of the quota, which is set by the government (OECD, 2014). In general, all forms of renewable energy generation are eligible, although large-scale hydropower facilities from before 2003 are not part of the system. Until 2012, biomass-generated electricity received the greatest number of certificates, but since then, wind power has become the cheapest option and now dominates with a share of 71% in 2017 (IEA, 2019). In addition to the electricity certificate system, investment grants for solar power were initiated in 2009, while a tax reduction for micro production of renewable energy was introduced in 2015 (Government Offices of Sweden, 2017c). However, financial support for wind power was phased out in 2012, after the effect of the electricity certificate scheme on wind power investments became clear (OECD, 2014).

As for the residential and service sector, policy measures considering the energy performance of buildings have been implemented, such as Swedish building regulations, which since the 1960s set minimum requirements for energy use in new buildings, as well as energy performance certificates for buildings based on the Energy Performance of Buildings Directive. Moreover, the Ecodesign Directive and Energy Labeling Directive regulating mandatory energy labeling as well as minimum energy efficiency requirements for products are relevant with regard to emission reductions in the residential and service sector (Government Offices of Sweden, 2017c).

With respect to industrial emissions from combustion and processes, important climate-related policy measures include two recent programs in support of research, development and investments to reduce process-related industrial emissions: Industrial leap (2018), which targets the Swedish industry in general, as well as Hydrogen Breakthrough Ironmaking Technology (HYBRIT) (2016), which supports the steel industry specifically (Government Offices of Sweden, 2017c). Moreover, the Energy

step program initiated in 2018 targets energy efficiency in the mining and manufacturing industry by supporting companies for in-depth environmental studies before investment decisions and providing investment grants for energy efficient alternatives (SEPA, 2019e). Earlier, a program for energy efficiency in energy-intensive industries gave companies the opportunity to obtain a tax exemption on electricity use, in return for a commitment to implement actions in order to improve their energy efficiency. This program was started in 2005, but ended in 2017, as it was considered to breach the revised EU state subsidy laws (IEA, 2016; Petersson et al., 2011). Furthermore, support is provided for measures related to energy audits and coaching, e.g. energy audits for large enterprises based on the Energy Efficiency Directive. The issue of fluorinated greenhouse gas (F-gas) emissions is mainly addressed through EU legislation (Government Offices of Sweden, 2017c).

Turning to the transport sector, relevant policies regarding the composition of the vehicle fleet include emission performance standards for new vehicles based on different EU regulations. Moreover, a differentiated vehicle tax in relation to CO_2 emissions per kilometer (2006), tax incentives for company cars with advanced environmental technology (2002) as well as a bonus-malus system supporting vehicles with low CO_2 emissions with a bonus and taxing vehicles with high emissions at a higher rate are in place. The bonus-malus system introduced in 2018 replaces the former tax exemptions for environmentally friendly vehicles (2009-2018) and the super-green car rebate (2012-2018). Regarding the promotion of renewable transport fuels, an emission reduction obligation requiring petrol and diesel suppliers to reduce CO_2 emissions through increased biofuel blending was introduced in 2018 in fulfillment of the EU Renewables Directive. This was accompanied by a number of tax rule changes for biofuels. Additionally, filling stations are obliged to supply at least one kind of renewable fuel since 2006. In recent years various investment grants have become available, such as for charging infrastructure in private homes and along roads (2018), for electric buses in regional public transport (2016), and for public transport and cycling infrastructure at the regional or local level (2015). Ultimately, shipping and aviation are targeted since 2018 through an eco-bonus system, which stimulates the transfer of freight transport by road to shipping, and a tax on air travel for commercial flights departing from Swedish airports (Government Offices of Sweden, 2017c; SEPA, 2019e).

The waste management sector is influenced heavily by EU legislation, e.g. with regard to reduced landfilling of organic waste, methane collection from landfills and producer responsibility for certain products. Sweden has, however, introduced more far-reaching national instruments, such as a complete ban on landfilling of combustible (2002) and organic waste (2005). In order to further divert waste from landfilling, a landfill tax was introduced in 2000 and gradually increased thereafter.

Finally, since 1991 Swedish municipalities are required to develop municipal waste plans (Government Offices of Sweden, 2017c).

As for agriculture, relatively few policy instruments directly targeting GHG emissions in this sector are in place. One of the most relevant instruments is the Rural Development Program under the Common Agricultural Policy of the EU, which supports measures providing non-profitable services to the wider public including climate change mitigation e.g. through improved manure handling or more efficient use of nitrogen. Moreover, a support scheme for biogas production from manure was introduced in 2015. Forestry is mainly addressed through the Swedish Forestry Act, which aims for sustainable forest production, as well as through the Swedish National Forest Program, which establishes goals and action plans to increase the national supply of bio-based alternative fuels (Government Offices of Sweden, 2017c).

Table 2 summarizes existing climate-related policy measures in Sweden divided by sectors and indicates the starting year of their implementation. Additionally, EU-regulated policy measures are marked in blue.

Table 2: Existing climate-related policy measures in Sweden divided by sectors (Adapted from Government Offices of Sweden, 2017c, p 63ff; SEPA, 2019e)

Cross-sectoral instruments	
Local climate investment program (Climate leap)	2015
Environmental Code	1999
Planning and Building Act	2011
Fossil-Free Sweden initiative (platform for dialogue and cooperation)	2015
Climate and energy advice	1998
Research and development	1990
Production of electricity and district heating	
Energy tax	1957
CO_2 tax	1991
Electricity certificates system (in support of renewable energy)	2003
EU ETS	2005
Initiatives for wind power (simplifying rules and information)	N/A
Support for solar power	2009
Tax reduction for micro production of renewable energy	2015
Residential and service sector	
Energy tax	1957
CO_2 tax	1991
Building regulations (energy requirements for new buildings)	1960s
Energy performance certificates for buildings – based on Energy Performance of Buildings Directive (2010/31/EC)	2006
Ecodesign Act (energy efficiency and environmental requirements for products) – based on Ecodesign Directive (revised 2009/125/EC)	2010
Mandatory energy labelling for products e.g. domestic appliances – based on Energy Labelling Directive (2010/30/EU)	1995
Support for renovation and energy efficiency of rental appartements	2016
Training programs in building for low energy consumption	2016
Technology procurement	N/A
Industrial emissions from combustion and processes incl. fluorinated GHG	
Energy tax	1957
CO_2 tax	1991
EU ETS	2005
Hydrogen Breakthrough Ironmaking Technology (HYBRIT)	2016
Industrial leap (support for reducing process-related emissions in industry)	2018
Energy step (energy efficiency program in the mining and manufacturing industry)	2018
Energy audit for large enterprises – based on Energy Efficiency Directive 2012/27/EU	2014
Grants for energy audit to small and medium-sized enterprises	2010
Energy and climate coaches for small and medium-sized enterprises	2016
Energy efficiency networks for small and medium-sized enterprises	2015
Environmental Code	1999
EU regulation (No 517/2014) on fluorinated GHG (F-gases) and Best Available Techniques reference document (BREF) for the non-ferrous metal industry	2015
EU Directive on F-gases used in mobile air conditioning units in cars (2006/40/EC)	2006
Swedish regulation on F-gases and ozone depleting substances	2016
Transport	
Energy tax	1924
CO_2 tax	1991
Emission performance standards for new vehicles – based on EU regulations Nos 443/2009, 333/2014, 510/2011 and 253/2014	2015
Differentiated vehicle tax	2006
Lower benefit value on company cars with advanced environmental technology	2002
Bonus-malus system for new light vehicles	2018
Emission reduction obligation requiring increased biofuel blending – based on EU Renewables Directive (2009/28/EC)	2018
Requirements of renewable fuels at filling stations	2006
Charge at home-grant for electric vehicles	2018
Grants for technology neutral charging infrastructure along roads	2018
Urban environment agreements (investments in public transport and cycling infrastructure)	2015
Electrical bus premium	2016
Tax on air travel	2018
Eco-bonus system (supporting the transfer of goods from road to shipping)	2018
Waste	
Rules on municipal waste planning (1991) and on producer responsibility for certain products (1994), landfill tax (2000), bans on landfill of combustible waste (2002) and of organic waste (2005) – partly based on EU legislation such as Landfill Directive (1999/31/EC)	N/A
Agriculture	
Rural Development Program incl. support for mitigation measures (2^{nd} pillar of Common Agricultural Policy CAP)	2014
Support for biogas production	2015
The Rural Network	N/A
Land use, land use change and forestry (LULUCF)	
Provisions of Forestry Act	1993
Provisions of Environmental Code, e.g. land drainage, nature reserves and habitat protection	1999
Swedish National Forest Program	2018
Advice and training	N/A

In the following, connections between the energy mix and emission developments explained in Section 4.1.2 and the climate policy developments described above are established.

First, Swedish electricity production from non-fossil fuels such as nuclear power, hydro power, wind power and biofuels expanded strongly, which despite increased electricity demand reduced GHG emissions from electricity production (SEPA, 2018a). With regard to electricity from renewable sources, in particular wind power and biofuels, this trend can largely be attributed to the support of the electricity certificate scheme (Ericsson, 2009).

Second, the infrastructure for district heating production and distribution was extended, followed by a transition from oil-fired boilers to electricity and district heating. Simultaneously, the use of biofuels and waste in electricity and district heating production increased strongly as well (SEPA, 2018a). These developments led to emission reductions from heating of houses and premises as well as the production of electricity and district heating. Respective emission reductions were mainly achieved as investing in district heating network extension, new small-scale district heating systems and combined heat and power (CHP) facilities became financially competitive for two reasons: the local climate investment programs (i.e. LIP, KLIMP, Climate Leap) supported investments, and the energy and CO_2 tax on fossil fuels made biofuels the cheapest fuel in heat production (Ericsson, 2009). As a consequence, the production of district heating has increased by about 50% since 1990, while GHG emissions from this sector have remained relatively unchanged (Government Offices of Sweden, 2017c).

Third, emissions from waste management decreased strongly, due to a reduction of landfilling of untreated waste. This can mainly be attributed to the introduction of a landfill tax and a ban on landfilling of combustible wastes, which also increased the attractiveness of using waste as a fuel in district heating networks and industry (OECD, 2014).

Fourth, emission reductions in industry can partly be attributed to a transition from fossil fuels to biofuels, in addition to energy efficiency measures as well as changing volumes of production due to changing economic developments (SEPA, 2018a). However, as industry not covered by the EU ETS until recently benefited from lower CO_2 tax levels, this instrument arguably did not harness its full potential regarding emission reductions. Nonetheless, respective CO_2 tax reductions have been abolished in 2018, which means this situation might change in the future. Furthermore, as industry covered by the EU ETS has been exempt from the CO_2 tax, respective sectors highly depend on the effectiveness of the EU ETS (Friberg, 2008). This is particularly problematic as the EU ETS is widely criticized for not delivering sufficient emission reductions.

Fifth, since the phasing out of ozone depleting substances after the Montreal Protocol of 1989, the use of F-gases has increased strongly, leading to a rise in emissions of these substances in the early 1990s. However, in 2006 the EU directive on F-gases resulted in a stabilization of these emissions, whereas the new EU directive from 2015 aims to further reduce F-gas emissions by two thirds from current levels until 2030 (SEPA, 2017a).

Sixth, emissions reductions in agriculture were mainly caused by reduction in the number of animals, increased productivity and lower use of mineral fertilizer. These developments cannot be ascribed to specific climate policy measures in this sector (SEPA, 2018a).

Finally, only relatively little emission reductions in domestic transport have been achieved from 1990 to 2016. Although the increased use of biofuels and higher efficiency of vehicles reduced the carbon intensity of transport, this was counteracted by an increase of total traffic volume (SEPA, 2018a).

4.1.4 Institutional arrangements

In Sweden, the Ministry of the Environment has the primary responsibility for policy-making regarding climate change and delegates policy implementation and monitoring as well as emission reporting to the Swedish Environmental Protection Agency (SEPA). However, responsibilities for climate policy measures are further spread across several ministries and government agencies, whose main tasks are often not climate-related (OECD, 2014). In particular, several areas covered by the Ministry of Enterprise and Innovation, Ministry of Infrastructure as well as the Ministry of Finance are very important to Swedish climate policy-making. The Ministry of Enterprise and Innovation is, amongst others, responsible for areas such as enterprise and industrial policy, rural affairs and regional growth (Government Offices of Sweden, 2019a). The Ministry of Infrastructure is, amongst others, responsible for matters relating to infrastructure, transport and energy (Government Offices of Sweden, 2019b). The Ministry of Finance is in charge of fiscal policy and in this context also responsible for the important climate policy instrument of energy and carbon taxing (Swedish National Audit Office, 2014). In addition, the Ministry of Finance is also responsible for matters relating to housing and community planning (Government Offices of Sweden, 2019c). At the ministerial level, policy coordination is pursued through joint preparation procedures known as joint drafting. This procedure determines that when a policy issue concerns another ministry's area of responsibility, it must be handled in consultation with that ministry. This administrative procedure is supported by the principle of collective responsibility amongst Swedish government ministers (Nilsson and Persson, 2008). Despite this rather inclusive approach to decision-making, both the OECD as well as the Swedish National Audit Office highlight that institutional arrangements for better coordination be-

tween sectors and clearer distribution of responsibilities as well as joint transparent reporting and monitoring are needed (OECD, 2014; Swedish National Audit Office, 2014).

Moreover, each ministry is responsible for a number of government agencies, which carry out much of the policy preparatory work as well as the implementation of policies. They are governed through standing instructions as well as a set of annually updated directions, which set out the objectives and budget of their activities. Ultimately, the agencies are accountable for and obliged to report on their activities. This shows that the ministries have substantial scope for directing the activities of government agencies, however, in day-to-day activities governmental agencies are independent with regard to policy implementation. Unlike in many other countries the possibility of 'ministerial rule' does not exist in Sweden (Nilsson and Persson, 2008). The following government agencies play a key role in Sweden's climate policy:

- Government agencies subordinate to the Ministry of the Environment:
  - Swedish Environmental Protection Agency (responsible for environmental issues e.g. Local climate investment program, Environmental Code, regulation on F-gases and ozone depleting substances, rules on municipal waste planning, producer responsibility for certain products, bans on landfill of combustible and organic waste, grants for technology neutral charging infrastructure, charge at home grant for electric vehicles)

- Government agencies subordinate to the Ministry of Enterprise and Innovation:
  - Swedish Forest Agency (responsible for issues concerning forestry e.g. Swedish National Forest Program, provisions of Forestry Act)
  - Swedish Board of Agriculture (responsible for agricultural policy e.g. support for biogas production, measures under the Rural Development Program)

- Government agencies subordinate to the Ministry of Infrastructure:
  - Swedish Transport Administration (responsible for infrastructure planning for road, rail, sea and air transport e.g. emission performance standards for new vehicles, investments in public transport and cycling infrastructure, eco-bonus supporting transfer of goods from road to shipping)
  - Swedish Transport Agency (responsible for regulation and supervision in the transport sector e.g. bonus-malus-system for new light vehicles)
  - Swedish Energy Agency (responsible for the supply and use of energy e.g. electricity certificates systems, initiatives for wind power, support for solar power, energy efficiency and environmental requirements for products, mandatory energy labeling, energy audit for enterprises, cli-

mate and energy advice, support for renovation and energy efficiency of rental apartments, electrical bus premium, HYBRIT, industrial leap, technology procurement, research and development, emission reduction obligation through increased biofuel blending)

- Government agencies subordinate to the Ministry of Finance:
  - Swedish Tax Agency (responsible for collecting taxes e.g. energy tax, carbon dioxide tax, landfill tax, income tax for micro production of renewable energy, differentiated vehicle tax, lower benefit value on company cars with advanced environmental technology, tax on air travel)
  - Swedish National Board of Housing, Building and Planning (responsible for reviewing developments in the field of housing, building and planning e.g. Planning and Building Act, building regulations, energy declarations for buildings) (Government Offices of Sweden, 2017c; SEPA, 2019e)

4.2 Swedish Climate Policy Framework

In October 2012, a proposal for a Swedish Climate Policy Framework was first brought up in a parliamentary motion by the Green Party. The proposal explicitly drew on the example of the UK CCA and initially comprised the introduction of carbon budgets as pathways to meet the climate goals. The parliamentary motion was supported by the Green Party, the Social Democratic Party and the Left Party, who were all in opposition at the time, but ultimately the needed majority in parliament was not reached (Motion 2012/13:MJ481).

After a change of government following the general elections in 2014, the new minority government led by Prime Minister Stefan Löfven (hereinafter called Löfven Cabinet), consisting of the Social Democratic Party and the Green Party, announced the introduction of a Swedish Climate Policy Framework in its Statement of Government Policy (Government Offices of Sweden, 2017a). It should be noted that this has been the first government participation for the Green Party and that the introduction of a climate policy framework including a climate law has been their foremost election promise at the time (The Greens European Free Alliance, 2017). In December 2014, the CPCEO was subsequently tasked by the Löfven Cabinet to bring forward a proposal both for a new climate strategy for Sweden and a Swedish Climate Policy Framework (Government Offices of Sweden, 2017a). The CPCEO consists of members of parliament and advisers from civil society groups as well as government ministries (SEPA, 2012). Seven out of the eight currently represented parties in parliament are part of the CPCEO, and only the far-right Swedish Democrats did not participate in the consultations. In March 2016, the CPCEO was able to present its final proposal for a new climate strategy for Sweden and a Swedish Climate Policy

Framework in two partial reports (SOU 2016:47 and SOU 2016:21), which was sent to about 200 different stakeholders for comments (Regeringskansliet, 2016).

Overall, the CPCEO's reports do not give any details on the proceedings of the consultations and further do not give insights on how the committee arrived at its recommendations. The written government order to the CPCEO for instance explicitly mentions analyzing the need for a possible introduction of carbon budgets, however, the CPCEO does not provide any reasoning why these were ultimately not included in the proposal for a Swedish Climate Policy Framework. Nevertheless, the CPCEO emphasizes that it engaged in a broad dialogue with diverse stakeholders and highlights the consideration of the following documents: Intergovernmental Panel on Climate Change (IPCC) fifth assessment report, review on the climate area 2009-2013 by the Swedish National Audit Office, OECD Environmental Performance Review for Sweden, an analysis by SEPA on a roadmap for a Sweden without emissions by 2050 as well as the 2015 Global Climate Legislation Study (with a particular focus on CCAs in the UK, Germany, Denmark and Finland). Moreover, the CPCEO also commissioned expert reports on different topics e.g. on constitutional aspects of a climate policy framework (Patrik Bremdal), consequences and notable aspects for the political system regarding the introduction of a climate law in Sweden (Simon Matti) as well as an analysis of international legal developments towards a legal responsibility for nation states to counteract climate change (Kristina Forsbacka). The committee also organized several workshops during the course of consultations (some with international guests) e.g. on the UK's and Germany's experiences in climate and energy policy (SOU 2016:47 and SOU 2016:21).

Ultimately, the CPCEO's proposal was backed by the Social Democratic Party, the Green Party, the Moderate Party, the Liberal Party, the Centre Party, the Christian Democrats and in some parts also by the Left Party (Government Offices of Sweden, 2017b). The lack of support from the far-right Sweden Democrats comes as no surprise considering that they were not invited by the Löfven Cabinet to participate in the CPCEO's consultations in the first place, assumingly because the Löfven Cabinet did not see any possibility to reach a political agreement with them.

Based on the proposals of the CPCEO and without any major changes, the Löfven Cabinet presented a new climate strategy for Sweden in a written government communication to the parliament in April 2018 (Skr. 2017/18:238) and its Swedish Climate Policy Framework in a government bill in March 2017 (Prop. 2016/17:146). The new climate strategy for Sweden forms the basis for Sweden's 2050 low GHG emission development strategy, a policy document all parties to the Paris Agreement have committed to submit latest by 2020 (SEPA, 2018b). In contrast, the Swedish Climate Policy Framework contains a proposal for a Swedish Climate Act (SCA) (see Section 4.2.2), which establishes general provisions on the government's work on

climate policy as well as a planning and reporting system regarding climate policy. In addition, the Swedish Climate Policy Framework comprises new climate goals for 2030, 2040 and 2045 (see Section 4.2.1) as well as plans for the establishment and mandate of a Climate Policy Council (CPC) (see Section 4.2.3), which are, however, both not regulated by the SCA (Prop. 2016/17:146).

Overall, the Swedish Climate Policy Framework can be regarded as a key component of Sweden's efforts to live up to the Paris Agreement. In this context the government bill emphasizes that Sweden shall act as a front-runner in implementing the Paris Agreement as well as take on responsibility for its historic emissions (Prop. 2016/17:146). In addition, it is noteworthy that the CPCEO's proposal on the Swedish Climate Policy Framework, as well as the subsequent government bill, focus on mitigation only and are thus not integrating the issue of climate change adaptation. This separation has been criticized by several institutions during the consultation phase of the CPCEO's proposal (Regeringskansliet, 2016). At the time Sweden was one out of only a few EU member countries still lacking a national climate adaptation strategy. Ultimately, a government bill on a national climate adaptation strategy for Sweden was presented in March 2018 (Prop. 2017/18:163).

4.2.1 Swedish climate goals

The new climate goals enshrined in the Swedish Climate Policy Framework, though not regulated by the SCA, consist of a long-term climate goal for the year 2045, interim targets for the years 2030 and 2040 as well as an interim target for the transport sector to be reached by 2030. The climate goal for the year 2020 adopted in 2009, which calls for a reduction of 40% for emissions not covered by the EU ETS, remains unchanged. Both the new long-term target and the new interim targets are included as milestone targets in the EQO system under the EQO "Reduced Climate Impact" (see Section 4.1.1). As before, Sweden's climate policy in general is thus centered around the EQO "Reduced Climate Impact".

As mentioned earlier, the introduction of new climate goals as a part of the Swedish Climate Policy Framework is a key component of Sweden's efforts to live up to the Paris Agreement. In this context, the specifications of the EQO "Reduced Climate Impact" have been amended according to the temperature goal of the Paris Agreement. Before, the EQO "Reduced Climate Impact" included specifications on an increase in global average temperature of no more than 2°C, which has now been changed to well below 2°C and striving for 1.5°C. The former specification on limiting global atmospheric concentrations of GHG to 400 ppm CO_2-equivalent has been revoked due to uncertainties regarding accordance with the temperature goal (Prop. 2016/17:146).

Table 3 gives an overview on the climate goals adopted in 2009 and 2017. Moreover, Figure 7 puts the climate goals adopted in 2017 in relation to Sweden's historic emission developments. As supplementary measures can count towards reaching the climate goals, Figure 7 shows a range corresponding to emission levels with and without the use of supplementary measures. Subsequently, the respective goals are elaborated in further detail.

With its new long-term climate goal, Sweden is aiming for net-zero emissions by 2045 and negative emissions thereafter. Sweden's previous vision to reach net-zero emissions by 2050 (see Section 4.1.1) has thus been replaced by the formulation of an explicit long-term target and the target year has been brought forward by five years. In order to meet this new long-term goal, Sweden has the possibility to use supplementary measures such as increased uptake of CO_2 by carbon sinks or investing in climate projects abroad, but only to the extent set out in Table 3. In case other reasonable alternatives are not available, carbon capture and storage can be considered as a supplementary measure for emission reduction as well. Nevertheless, the actual domestic emissions by 2045 shall at least be 85% lower compared to 1990 levels. Moreover, it is foreseen that supplementary measures for emission reduction need to increase after 2045 to further achieve net-negative emissions (Prop. 2016/17:146). SEPA has confirmed that the new long-term climate goal is in line with the latest IPCC emission pathways limiting global temperature rise to 1.5°C[6] (SEPA, 2019d). However, the emission reduction rate of Sweden's total domestic emissions amounted to only 2% per year on average between 2005 and 2016 and in particular since 2014 emission levels have remained largely unchanged. In order to reach the long-term goal of net-zero emissions by 2045, the emission reduction rate needs to increase to 5-8% per year depending on the amount of supplementary measures used (SEPA, 2017a). Scenario analysis by SEPA further indicates that with existing measures total GHG emissions in 2045 are estimated to be only 34-41% lower compared to 1990 (SEPA, 2019d).

The new interim targets for emissions not covered by the EU ETS are set to a 63% reduction by 2030 and a 75% reduction by 2040, compared to 1990 levels. Only 8 percentage points of this reduction may be achieved through supplementary measures for the interim target for 2030, whereas just 2 percentage points are allowed by 2040. The interim target for domestic transport foresees an emission reduction of 70% until 2030 compared to 2010 levels. Domestic aviation is excluded from this target since it

[6] According to the findings of the IPCC special report on the impacts of global warming of 1.5°C, CO_2 emissions need to reach net-zero by the middle of the century in order to limit global temperature rise to 1.5°C, while limiting the emissions of other GHGs to very low levels. In almost all 1.5°C emission pathways, temperature rise will temporarily exceed the 1.5°C target and then, with help of negative emissions, decline again towards the end of the century (so called overshoot). To completely prevent or limit such an overshoot, global CO_2 emissions need to be reduced by 50% until 2030 compared to 2010 (IPCC, 2018).

Table 3: Sweden's historic emission reductions compared to its existing and new climate goals (Adapted from SEPA, 2018b, p 5)

	Historic emissions	**Climate goal adopted in 2009 (Rskr. 2008/09:300)**	**Climate goals adopted in 2017 (Rskr. 2016/17:320)**	
Total emissions	**-26%**		**net-zero** by 2045 compared to 1990 max. 15 percentage points through supplementary measures	
Emissions not covered by EU ETS	**-30%** 1990-2016	**-40%** by 2020 compared to 1990 max. 13.3 percentage points through supplementary measures	**-63%** by 2030 compared to 1990 max. 8 percentage points through supplementary measures	**-75%** by 2040 compared to 1990 max. 2 percentage points through supplementary measures
Emissions from domestic transport	**-18%** 2010-2016 excl. domestic aviation		**-70%** by 2030 compared to 2010	

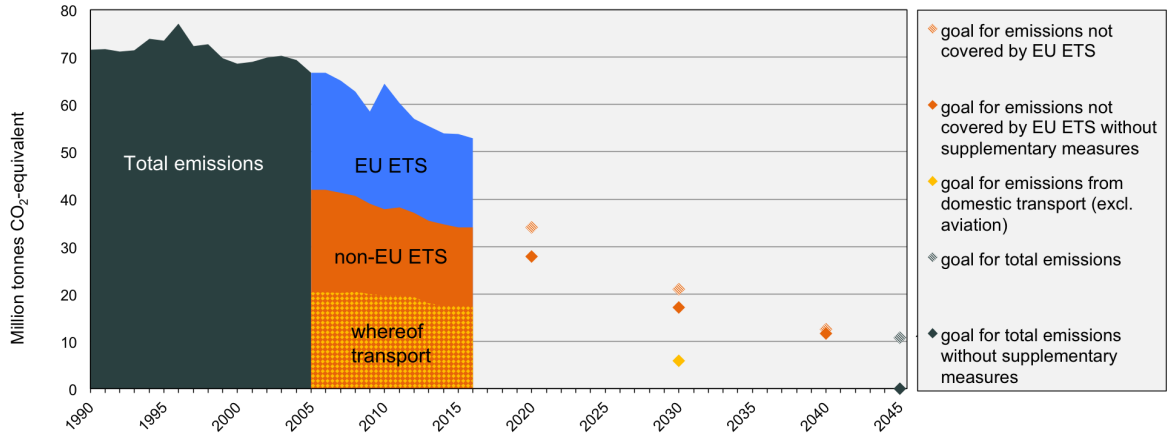

Figure 7: Sweden's emission development 1990-2016 compared to its existing and new climate goals, 1,000 tonnes CO_2-equivalent (Adapted from Prop. 2018/19:1, section 20, annex climate report, p 6; Data from SEPA, 2017c)

is covered by the EU ETS (Prop. 2016/17:146). Emissions from sectors not covered by the EU ETS have been reduced by a rate of 2% per year on average between 2005 and 2016. To reach the interim targets for 2030 and 2040, this annual reduction rate needs to increase to 3-4.5% per year depending on the amount of supplementary measures used (SEPA, 2017a). Scenario analysis by SEPA further shows that with existing measures emissions not covered by the EU ETS are estimated to be only 43-45% lower in 2030 and 44-50% lower in 2040 compared to 1990 (SEPA, 2019d). As for emissions from domestic transport excluding domestic aviation, the annual reduction rate amounted on average to 3% between 2010 and 2016. However, to reach the interim target for domestic transport this annual reduction rate needs to increase to 7% per year (SEPA, 2017a). Scenario analysis by SEPA further indicates that with existing measures emissions from domestic transport are estimated to be only 33-40% lower in 2030 compared to 2010 (SEPA, 2019d). This gap clearly shows the high ambition of the interim target for domestic transport, while it highlights the major challenge regarding further emission reductions in the transport sector as well.

For the EU as a whole, the European Council agreed in October 2014 on a reduction target of 30% by 2030 for emissions not covered by the EU ETS compared to 2005 levels including emissions and removal of CO_2 from land use, land use change and forestry (LULUCF). The "Effort Sharing Regulation 2021-2030", adopted in May 2018, translates this commitment into targets for each member state, which for Sweden results in a reduction target of 40%. Comparing Sweden's national interim target for 2030 (i.e. reduction of 30.2 $MtCO_2e$) to its obligations under the "Effort Sharing Regulation" (i.e. reduction of 16.8 $MtCO_2e$) clearly shows that Sweden's national commitment is more ambitious with regard to overall emission reductions (Prop. 2016/17:146; EC, 2018a). In this context it is noteworthy that Sweden has continuously been advocating for more ambitious EU-wide emission reduction targets (OECD, 2014).

Furthermore, emissions from sectors covered by the EU ETS, which in 2016 amounted to 37% of Sweden's total emissions, are only covered by the long-term goal. This means that there are no separate interim targets for sectors covered by the EU ETS on a national level, however, for the EU as a whole emissions covered by the EU ETS shall be reduced by 43% until 2030 compared to 2005 levels. Noteworthy is that the government's climate policy framework bill emphasizes that higher ambitions within the EU ETS are a requirement for reaching the new long-term goal (Prop. 2016/17:146). However, during the consultation phase of the CPCEO's proposal, representatives from the Swedish basic industry highlighted in this regard that a tightening of the EU ETS cap will not necessarily lead to emission reductions in Sweden, and further explained that as a market-based instrument the scheme prioritizes cost-efficient emission reductions, regardless of where in Europe they are

implemented (Regeringskansliet, 2016). This is particularly striking as scenario analysis by SEPA clearly indicates major shortcomings regarding emission reductions in sectors covered by the EU ETS, showing that with existing measures, emissions from these sectors will remain unchanged for the upcoming decades (SEPA, 2018c).

The climate goals elaborated above are not numerically included in the legislative text of the SCA (see Section 4.2.2), yet the act makes a reference that the climate goals shall function as a basis for the government's climate policy (SFS 2017:720 § 3). Instead, the climate goals have been adopted with a so-called parliamentary directive (Rskr. 2016/17:320), similar to the climate goal for the year 2020 adopted in 2009 (Rskr. 2008/09:300). In general, such parliamentary directives set a direction or overall goal for activities of the government and build on a broad agreement supported by the parliament. The new climate goals thus limit the government's political freedom of action but are not legally binding. This leaves the government with more flexibility and the possibility to adapt the climate goals according to changing circumstances, including both a tightening or weakening of the goals (Bremdal, 2016). According to Anders Wijkman, chairperson of the CPCEO at the time of consultations, the reason for not including the climate goals in the legislative text of the SCA was the CPCEO's inability to find a common agreement on this matter. In particular the Green Party and the Left Party where advocating for numerically including the goals in the legislative text, but priority was finally given to establishing a broader consensus for the Swedish Climate Policy Framework, instead of persisting for a stronger commitment regarding the climate goals (Wijkman, 2017).

Reactions from different stakeholders towards the proposed climate goals have in many regards been critical. For example, Johanna Sandahl, chairperson of the Swedish Society for Nature Conservation, argues that Sweden does not meet its historic responsibilities with reaching net-zero emissions only in 2045, because such an emission pathway does not allow for developing countries to expand their emissions to a globally equal share. Thus, Sweden would claim a bigger than average part of the global capacity to emit, which would then again aggravate existing carbon inequalities (SOU 2016:21). In contrast, Swedish industry representatives fear economic drawbacks if Sweden acts as a front-runner regarding climate change mitigation and other countries might not comply with their commitments. Also the Swedish Fiscal Policy Council regards a pioneering role for Sweden critically, considering the risk that climate policy measures might be implemented in a cost-inefficient way (Regeringskansliet, 2016).

4.2.2 Swedish Climate Act (SCA)

The SCA was adopted by parliament in June 2017 and entered into force in January 2018 (SFS 2017:720). Overall, the adoption of the SCA built on broad support across Sweden's political spectrum. All parties in parliament except the far-right Swedish

Democrats supported the SCA with 254 members of parliament (MPs) voting in favor and only 41 voting against the act (Riksdag, 2017). The act contains general provisions on how the government's work on climate policy shall be carried out and what it shall aim for (Regeringskansliet, 2017). In this regard, the SCA foresees that the overall aim of the government's climate policy shall be to prevent dangerous interference with the climate system and thus protect ecosystems as well as present and future generations against harmful effects of climate change. Moreover, the SCA emphasizes that the government's climate policy shall rest on a scientific basis and shall be based on relevant technical, social, economical as well as environmental considerations. In addition, the SCA outlines that the government's mitigation efforts shall be directed both at minimizing GHG emissions as well as at preserving and creating functions in the environment that counteract climate change, e.g. increasing the capacity of carbon sinks such as forests and soils (SFS 2017:720 § 2).

The government's work on climate policy shall moreover be conducted in such a way as to allow for climate policy objectives and budgetary policy objectives to cooperate with each other (SFS 2017:720 § 3). However, there are several imaginable situations where budgetary policy objectives and climate policy objectives do not correlate and the provision does not specify which objectives shall be given higher priority in such cases. Furthermore, the SCA highlights that the long-term climate goal adopted by the parliament in a separate parliamentary directive (see Section 4.2.1) shall act as a basis for the government's climate policy. In this context, the SCA also calls on the government to establish interim emission reduction goals needed for reaching the long-term goal (SFS 2017:720 § 3). Such interim targets are either established by the government or, as has been the case so far, are adopted by the parliament (Prop. 2016/17:146).

Besides general provisions on the government's work on climate policy, the SCA also establishes obligations for the government to present an annual climate report and draw up a climate policy action plan every four years (Regeringskansliet, 2017). As for the annual climate report, the government is required to present such a report every year in its budget bill to the parliament (Government Offices of Sweden, 2017b). As stated in § 4 of the SCA, the government's annual climate report shall include information on:

- emission developments,
- the most important measures taken and their impact on emission developments, as well as
- an assessment of whether further measures are needed and when and how such measures should be adopted (SFS 2017:720 § 4).

Overall, budget debates usually receive a lot of public attention in Sweden, which in regard to climate reporting could raise the importance of climate action, however,

there also remains a risk of low attention towards climate reporting due to the many other issues of the annual budget bill (Duwe et al., 2017). Prior to the enforcement of the SCA, the government reported on its work on climate policy in the annual budget bill under the section "Environment and Nature Protection" in the context of the EQO "Reduced Climate Impact" (SOU 2016:21). The submission of the annual budget bill in November 2018 has shown that the government's first climate report under the SCA was included in a similar way as an annex to the section "Environment and Nature Protection" (Prop. 2018/19:1, section 20, annex climate report). This positioning of the government's climate report has been criticized by the CPC, as it signalizes an unchanged treatment of climate policy foremost in the context of environmental policy and not as a cross-cutting issue for all policy areas (Klimatpolitiska rådet, 2019a).

The CPC further emphasizes that the government's first climate report only partially complies with the provisions of the SCA. First, the report focuses primarily on measures directly aiming at GHG emissions reductions but lacks assessment of measures in other policy fields, which may nevertheless have strong impact on emission developments. Second, the government does not provide assessments of how the reported measures affect emission developments. Third, the report states that additional measures are needed in all sectors, but fails to provide details on the nature of such measures as well as when and how decisions on such measures will be taken (Klimatpolitiska rådet, 2019a). This criticism may be partially ascribed to the fact that the budget bill in November 2018 was submitted by an interim government with a limited mandate, after several attempts to form a new government following the elections in September 2018 had failed.

Furthermore, it is important to emphasize that climate reporting under the SCA primarily focuses on evaluation of progress towards achieving the set climate goals, which means that the assessments and information provided strongly depend on the framing of the climate goals. This is relevant insofar as emissions from sectors covered by the EU ETS are currently only covered by the overall long-term goal but not by separate interim targets (see Section 4.2.1). As a consequence, no assessments dealing in particular with emission developments in sectors covered by the EU ETS are included in the first climate report, instead emissions from these sectors are only represented in assessments regarding the overall long-term goal. However, as mentioned in Section 4.2.1, SEPA estimates that with existing measures, emissions from these sectors will remain unchanged for the upcoming decades (SEPA, 2018c). These relevant insights are not replicated in the first climate report, which therefore only shows one side of the coin.

Ultimately, the SCA also obliges each government to present a climate policy action plan to parliament, in order to set out how the government intends to achieve the

climate goals. In line with Swedish government terms, such plans are drawn up every fourth year and shall be presented to parliament in the year after ordinary elections have been held. The first climate policy action plan will be presented in 2019, the year after the Swedish elections in September 2018 (Government Offices of Sweden, 2017b). However, as of September 2019, the government's first climate policy action plan has not yet been published, and can thus not be covered within the scope of this thesis. As stated in § 5 of the SCA, such a climate policy action plan should include information on:

- Sweden's commitment within the EU and internationally,
- historic emission data up to the last emission inventory,
- projected emission reductions,
- outcomes of already taken measures on emission reduction,
- planned measures for emission reduction including an approximate timeframe for implementation,
- projected outcomes of planned emission reduction measures with regard to national and international climate goals,
- the extent of planned emission reduction measures within different policy areas, as well as
- other measures needed to reach the national and international climate goals (SFS 2017:720 § 5).

In March 2019, SEPA submitted its contribution to the forthcoming climate policy action plan, as commissioned by the government, presenting assessments and background data on the points listed above. The report emphasizes three key challenges, which should be addressed in the government's first climate policy action plan: the low-carbon transformation of the transport system, reducing emissions from industry towards zero and promoting carbon capture and storage technologies to allow for negative emissions (SEPA, 2019d).

In general, the way in which such a climate policy action plan is submitted is up to each government and depending on whether a proposal for new legislation is put forward. If new legislation is proposed as part of the climate policy action plan, it is submitted as a government bill. Otherwise, a report is submitted to parliament as a non-binding government communication. Interestingly, the SCA foresees that each government submits a climate policy action plan only in the second year of their governmental term, which leaves the respective government with relatively little time for actual policy implementation and further suggests that the plans stretch over governmental terms, where a new government would in its first year theoretically work under the plan of the previous government (Duwe et al., 2017). It is of course highly questionable whether a new government would stick to a climate policy action plan drawn up by the previous government, in particular if such plans are submitted to parliament as non-binding government communications.

Like in many other countries the Swedish parliament has a control function to oversee the execution of laws by the government. In case of the SCA, the parliament has a clear mandate to monitor the planning and reporting obligations of the government, which means that the parliament may approve or call for further action regarding the government's annual climate reports or climate policy action plans. In this context, the SCA strengthens the government's accountability towards parliament concerning its work on climate policy. However, the parliament's conclusions in this regard are not legally binding (SOU 2016:21). As for the enforceability of the SCA, the act is targeted at the Swedish government and the responsibility for compliance lies collectively with all ministers, yet ultimately with the Swedish Prime Minister (Prop. 2016/17:146). Technically this means that the government is legally obliged to follow the regulations of the SCA and could even be subject to judicial review. Nevertheless, the current legal system in Sweden does not allow for a court to force a government to implement certain measures or condemn any sanctions against the government for non-compliance (SOU 2016:21). The Council on Legislation problematized this absence of sanctions for the government in case of non-compliance and concludes that the law can rather be compared to a non-binding political agreement (Prop. 2016/17:146 Bilaga 5). In response to this criticism, the government's climate policy framework bill refers to a possible examination of a minister's performance by the Committee on the Constitution and subsequently a motion of no confidence by the parliament, which is regarded as sufficient procedure to ensure that the law is executed as was intended (Prop. 2016/17:146). It is noteworthy that Sweden's parliamentary system has a tradition of following the party line, which means that individual parliamentarians only reluctantly vote against their party agenda. This makes it rather unlikely that a government not complying with the SCA will face an examination by the Committee on the Constitution or a motion of no confidence by the parliament (Matti, 2016). Finally, the provisions established by the SCA can of course be amended or abolished in case the act looses its support in parliament. However, contrary to an ordinance, the government is unable to amend the SCA by itself (SOU 2016:21).

According to the government's climate policy framework bill, regulating the underlying processes of each government's work on climate policy shall increase transparency, allowing citizens to better understand how climate policy efforts are proceeding and which further measures should be taken. Furthermore, the new law shall create more continuity and long-term orientation in climate policy by establishing planning and reporting obligations for each government. Finally, the government's climate policy framework bill emphasizes that the foremost intention with a regulation by law was to highlight the particular importance of climate change mitigation for humanity and give climate policy a prioritized position in Swedish politics. In this regard, the adoption of the SCA shall send a clear signal to both Swedish citizens and other countries that the Swedish state takes climate policy seriously (Prop. 2016/17:146).

4.2.3 Climate Policy Council (CPC)

The government's climate policy framework bill foresees the establishment of the CPC, whose main task shall be to evaluate if the overall policy put forward by the government is compatible with the set climate goals. In this context, the CPC was set up as an interdisciplinary expert body supporting the government with assessments and analyses (Government Offices of Sweden, 2017a). Its institutional set-up and scope of mandate strongly resembles that of the Swedish Fiscal Policy Council, which was established in 2007 as an agency under the government and tasked with reviewing and assessing whether the government's fiscal policy is in line with the set fiscal policy objectives (SFS 2011:446). The CPC was, similarly to the Fiscal Policy Council, established as an agency under the government and legally based on Ordinance 2017:1268 with the statute for the CPC (SFS 2017:1268). This ordinance was issued on December 2017 by the Löfven Cabinet and entered into force on January 2018, which also marks the start date for the activities of the CPC.

As for its organizational structure, the CPC consists of a chairperson, a vice chairperson and a maximum of six other council members (SFS 2017:1268 § 7). The CPC is quorate if a minimum of five council members, among them the chairperson or vice chairperson, are present (SFS 2017:1268 § 8). The government appoints the council members following a proposal from the CPC, which means that the council members themselves can choose their successors. The chairperson is appointed for a period of six years, whereas all other council members are appointed for three years. Proposed candidates shall have scientific competences in the study fields climate science, climate policy, economics, sociology or behavioral sciences. It is not clear whether this wording primarily calls for scientific competences gained through the pursuit of a scientific career or only requires an academic education background. Additionally, gender balance shall be considered in the selection of candidates as well (SFS 2017:1268 § 11). The first council members were appointed in December 2017 with a composition as follows:

- Ingrid Bonde as chairperson (economist),
- Johan Kuylenstierna as vice chairperson (associate professor in physical geography, Stockholm University) as well as
- Karin Bäckstrand (professor in environmental social science, Stockholm University),
- Katarina Eckerberg (professor in political science, Umeå University),
- Tomas Kåberger (professor in industrial energy policy, Chalmers University of Technology),
- Åsa Löfgren (associate professor in economics, Gothenburg University, School of Business, Economics and Law),
- Markku Rummukainen (professor in climatology, Lund University) and

- Sverker Sörlin (professor in environmental history, KTH Royal Institute of Technology) as council members (Klimatpolitiska rådet, 2019b).

The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning named Formas was chosen to host the CPC and support it with services such as administration and communication. This means that the CPC's secretariat is placed at Formas and that the secretariat's director is employed by Formas. Ola Alterå, who has a background both in industry and politics, was appointed as first director of the CPC by the Löfven Cabinet (Klimatpolitiska rådet, 2019c). The selection of his successor shall as well be based on a proposal of the CPC (SFS 2017:1268 § 12). In addition, the CPCEO's proposal has foreseen that another six to seven fulltime employees should work for the secretariat, which would have been similar to the workforce of the Swedish Fiscal Policy Council's secretariat (SOU 2016:21). However, as stated in the CPC's first annual assessment report, there are currently only two additional employees working for the CPC's secretariat (Klimatpolitiska rådet, 2018). As outlined in the government's climate policy framework bill an annual budget of about 1 million Euros is foreseen for the operation of the CPC (Prop. 2016/17:146).

The government's climate policy framework bill highlights the complexity of climate policy and the need to not only tackle the issue of climate change in the context of environmental policy but to demand responsibility of all other relevant policy areas as well. In this respect, the CPC as an interdisciplinary expert body is tasked with undertaking integrated assessments of the government's climate policy as a whole, which are expected to go further than what existing authorities are able to deliver (Prop. 2016/17:146). Nevertheless, the CPC has only limited resources to conduct its own studies and will therefore build its work for a large part on analyses from other government agencies and research bodies[7] (Klimatpolitiska rådet, 2018). In this context the assessments of the CPC shall be regarded as a second opinion and complementary to existing analyses by the respective government agencies (SOU 2016:21).

As stated in § 2 and § 3 of the ordinance, the CPC's tasks in particular are:

- evaluating if the present policies in different policy areas contribute or counteract the climate goals

[7]The CPC will base its work largely on analyses and evaluations of the following authorities: Scientific Council for Sustainable Development, Swedish Meteorological and Hydrological Institute, Swedish Delegation for the 2030 Agenda, SEPA, Swedish Agency for Growth Policy Analysis, Statistics Sweden, Swedish National Audit Office, Environmental Objectives Council, National Institute of Economic Research, Swedish Energy Agency, Swedish Agency for Public Management, Fossil Free Sweden initiative, Swedish Agency for Transport Policy Analysis as well as universities and other research bodies (Klimatpolitiska rådet, 2018).

- reviewing the effects of both existing and planned policies from a broad societal perspective,
- identifying policy areas in need of additional emission reduction measures,
- analyzing cost-efficiency with regard to short- and long-term goals,
- evaluating the analytical methods and models which the policies are based upon (SFS 2017:1268 § 2), as well as
- contributing to an increased debate on climate policy in society (SFS 2017:1268 § 3).

Regarding the last point, the CPC highlights that contributing to an increased public discussion on climate policy is a joint responsibility of several institutions including but not exclusively of the CPC (Klimatpolitiska rådet, 2018). As for evaluating whether policies are compatible with the set climate goals, the ordinance refers to the climate goals that have been adopted by the parliament as a part of the government's climate policy framework bill (SFS 2017:1268 § 1). In this context, the CPC highlights in its first annual assessment report that its task is to evaluate the attainment of the climate goals but not to question or engage in a debate on their ambitiousness (Klimatpolitiska rådet, 2018). Furthermore, it should be noted that the CPC is only tasked with evaluating the government's climate policy with regard to mitigation, while it does not have the mandate to evaluate the government's efforts on adaptation, which is in line with the general approach of the Swedish Climate Policy Framework (as outlined in Section 4.2).

The CPC's two main evaluation activities are annual ex-post assessments of the government's climate policy as well as an ex-ante assessment of the government's climate policy action plan every four years. As mentioned above, the CPC has a support function to the government and its conclusions and findings can only be understood as a form of advice or recommendations, but are in no regard legally binding for the government (SFS 2017:1268). In case of different opinions between council members regarding both evaluation activities, the general rule applies that these shall be elaborated in the reports (SFS 2017:1268 § 5).

Its annual assessment report on the government's climate policy shall be submitted to the government every year by the end of March, including an assessment on the development of the government's climate policy and the emission trends, an assessment on whether the overall policies put forward by the government are compatible with the climate goals, as well as other analyses and assessments undertaken by the CPC (SFS 2017:1268 § 5). The first assessment report was published in February 2018 and mainly comprises an introduction to the Swedish Climate Policy Framework and elaborations on the role and mandate of the CPC. It is noteworthy that this first report does not contain any evaluation of the government's climate policy or assessment on the likelihood of goal attainment regarding the climate goals. As-

sumingly, this was due to the fact that at the time the CPC was still setting up its operational structure. Additionally, the CPC states in its first assessment report that it will have to focus its analyses on the most critical issues due to the broad scope of its mandate (Klimatpolitiska rådet, 2018). Subsequently, the CPC published its second assessment report in March 2019 and has chosen to focus its assessment on policies that affect domestic transport emissions. Overall, the second assessment report concludes that only the interim target for 2020 is likely to be met and that all other interim targets as well as the long-term climate goal can not be reached with existing measures. In this context, the second assessment report highlights six overall recommendations concerning both government leadership and governance as well as cross-sector policy instruments and ten recommendations for a fossil-free transport sector (Klimatpolitiska rådet, 2019a).

As a second main evaluation activity, the CPC is tasked with conducting an assessment on the government's climate policy action plan, which needs to be completed within three months after the government's submission of the climate policy action plan (SFS 2017:1268 § 5). As of September 2019, the government's first climate policy action plan has not yet been presented. Considering that the CPC can take up to three months for assessing the climate policy action plan, the publication of the first ex-ante assessment is to be expected for early 2020.

The timeline in Figure 8 visualizes the planning and reporting system established by the SCA, including the evaluation activities of the CPC (highlighted in bold with grey background) over a governmental term of four years. In this context, it is important to mention that the Swedish parliament is usually elected for a fixed term of four years as well as that earlier elections during terms of office are very uncommon in Sweden (Riksdag, 2018). Information on the submission date for the government's climate policy action plan was taken from the CPCEO's proposal, yet the stated submission date has not been specified as such in the SCA, which only calls for the climate policy action plan to be submitted in the year after ordinary elections have been held (SOU 2016:21).

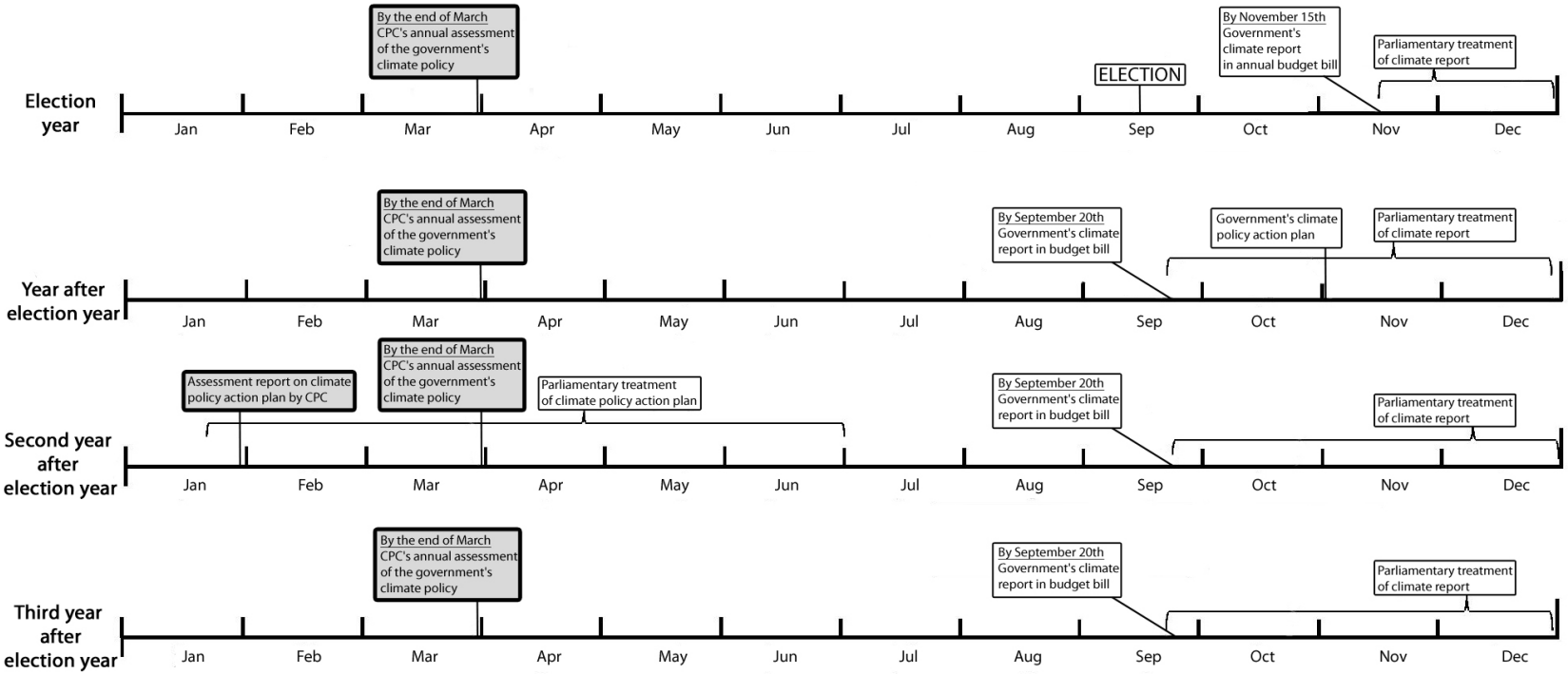

Figure 8: Timeline on the planning and reporting system established by the SCA including evaluation activities of the CPC over a governmental term of four years (Adapted from SOU 2016:21, p 62)

As already mentioned, the CPC has been legally implemented by an ordinance, which is less binding than the adoption of a law, since it is being adopted by the government and not the parliament. This allows for less political control by the parliament and means that the government can change the ordinance anytime (SOU 2016:21). For now, the CPC is only mentioned in Ordinance 2017:1268 with the statute for the CPC as well as the government's climate policy framework bill, but not in the legislative text of the SCA. If the CPC had been explicitly mentioned in the SCA's legislative text, it would have meant that the CPC as a government agency must exist as long as the law is in effect, however, such a regulation is rather unusual in Swedish legislation (Bremdal, 2016).

As a subordinate to the government, the CPC needs to give account of its work of the past year at the latest by February 22nd each year. This annual review shall also include information on the organizational structures of the CPC and its budget spending (SFS 2017:1268 § 4). Bearing in mind this accountability towards the government, the CPC cannot be regarded as completely independent. Nevertheless, the Löfven Cabinet strongly emphasizes the CPC's independent role in its public communication, which arguably relates mostly to the non-political and primarily scientific background of its members. Both the KTH Royal Institute of Technology and the Royal Swedish Academy of Agriculture and Forestry have criticized the positioning of the CPC as subordinate to the government and recommended a positioning as a subordinate to the parliament (Regeringskansliet, 2016). This way the government would have no possibility to influence the CPC's work, which then again also increases the CPC's credibility. Although it is rather unlikely that a government would consciously try to influence the CPC's work or that members of the CPC would deliberately withhold relevant information due to ideological considerations, positioning the CPC as subordinate to parliament would not leave room for the suspicion of any kind of irregularities and thus avoid negative effects to the general debate on climate change (Matti, 2016).

4.2.4 Preliminary conclusions

In the following, the within-case research question is answered for the Swedish case: **What are the key design elements of the Swedish Cimate Policy Framework in terms of targets set, procedures for planning, reporting and monitoring foreseen, their degree of implementation, as well as their legal bindingness and enforceability?**

The key design elements of the Swedish Climate Policy Framework are emission targets, a planning and reporting system for the government's work on climate policy regulated by the SCA and the creation as well as assigned evaluation activities of the CPC. It is important to note that both the emission targets and provisions regarding the CPC form part of the overall Swedish Climate Policy Framework, however, they

are not explicitly mentioned in the SCA and thus not regulated by law. The emission targets under the Swedish Climate Policy Framework consist of a long-term target aiming for net-zero emissions by 2045, interim targets for emissions not covered by the EU ETS aiming at 63% reduction by 2030 and 75% reduction by 2040 compared to 1990 as well as an interim target for emissions from domestic transport aiming at 70% reduction compared to 2010. This shows that emissions under the EU ETS are only covered by the long-term target but not the interim targets, which means no reduction pathway is set out for these respective sectors in Sweden. In addition, the Swedish Climate Policy Framework allows for offsetting in order to meet emission targets by indicating explicit allowances, i.e. 15 percentage points for the long-term target, 8 percentage points for the 2030 target and 2 percentage points for the 2040 target.

Both the long-term target and the interim targets were included as milestone targets in the already existing EQO system under the EQO "Reduced Climate Impact". Accordingly, Sweden's climate policy is, as was the case before, centered around the "Reduced Climate Impact" objective and no clear added value can be identified in a historic context. Moreover, the emission targets were adopted with a non-binding parliamentary directive, similar to the emission target for the year 2020 adopted in 2009. This leaves Swedish governments with great flexibility regarding possible amendments of emission targets, which thus can not be regarded as a stable long-term commitment. This is particularly relevant since the far-right Sweden Democrats, as only party opposing the Swedish Climate Policy Framework, received growing support from voters and became Sweden's third largest party at the last elections in September 2018. Furthermore, it is important to emphasize that Sweden is currently not on track for meeting its interim targets for 2030 and 2040, its interim target for the transport sector as well as its long-term target.

In addition, the SCA establishes a planning and reporting system requiring the government to present an annual climate report and draw up a climate policy action plan every four years in line with Swedish government terms. The annual climate report must be presented every year in the government's budget bill to parliament, thereby giving account on progress towards achieving the emission targets. Prior to the enforcement of the SCA, the government has similarly reported on climate policy as part of the annual budget bill and thus no clear added value can be identified in a historic context. With respect to the content of the annual climate report, governments must provide information on emission developments, measures taken and their impact on emission developments, as well as whether further measures are needed and when and how such measures should be adopted. The first two aspects can clearly be identified as retrospective reporting, however, the third aspect may rather be classified as planning and effectively constitutes a gap filler mechanism. The first annual climate report under the SCA was presented in the government's budget

bill in 2018, however, the CPC criticizes that the report only partially meets its requirements, as it primarily focuses on measures aiming directly at GHG emissions reductions but lacks assessment of measures in other policy fields. In addition, the report does not include assessments of how the reported measures affect emission developments and fails to provide details on further measures needed as well as when and how decisions on such measures will be taken. This criticism may partially be ascribed to the fact that the budget bill in 2018 was submitted by an interim government with a limited mandate, after several attempts to form a new government following the elections in September 2018 had failed. It remains to be seen whether the government's upcoming second annual climate report is able to overcome these shortcomings. The climate policy action plan shall set out how the government intends to achieve the emission targets and must be presented to parliament in the year after ordinary elections have been held. This leaves relatively little time to the respective government for actual policy implementation and further means that a new government would in its first year theoretically work under the plan of the previous government. However, it is highly questionable if a government would stick to a plan of its predecessor, in particular as such plans usually have no statutory basis. The first climate policy action plan will be presented in 2019, the year after the Swedish elections in September 2018. In general, the government is legally obliged to follow the provisions under the SCA and could even be subject to judicial review. However, the current legal system in Sweden does not allow for a court to force a government to implement certain measures or condemn any sanctions against the government for non-compliance.

The Swedish Climate Policy Framework further includes the establishment of the CPC, whose main evaluation activities are annual ex-post assessments of the government's climate policy, following the government's climate report in the annual budget bill, as well as an ex-ante assessment of the government's climate policy action plan every four years. The first annual assessment report was published in February 2018 and mainly comprises an introduction to the Swedish Climate Policy Framework and elaborations on the role and mandate of the CPC. This first report did not contain any evaluation of the government's climate policy or assessment on the likelihood of goal attainment regarding the climate goals. Assumingly, this was due to the fact that at the time the CPC was still setting up its operational structure. Additionally, the CPC states in its first assessment report that it has to focus its analyses on the most critical issues due to the broad scope of its mandate. Subsequently, the CPC published its second assessment report in March 2019 and has chosen to focus its assessment on policies that affect domestic transport emissions. The CPC's ex-ante assessment of the government's first climate policy action plan is expected for early 2020. In general, the CPC has limited capacities and resources to conduct its own studies and therefore builds its work for a large part on analyses from other government agencies and research bodies. In this context, the CPC's assessments

shall be regarded as a second opinion and complementary to existing analyses. As subordinate to government the CPC directly reports to government regarding its assessments. This means that the CPC needs to give account of its work to the same government it is tasked to scrutinize, which subsequently reduces its independence and credibility. Moreover, it was chosen to legally implement the CPC with an ordinance adopted by the government. This allows for less political control by the parliament and means that a future government can potentially abolish the CPC in case it disagrees with the CPC's mandate.

Chapter 5

United Kingdom

This chapter analyzes the key design elements of the UK CCA, thereby providing descriptive evidence for answering the within-case research question for the UK case: What are the key design elements of the UK CCA in terms of targets set, procedures for planning, reporting and monitoring foreseen, their degree of implementation, as well as their legal bindingness and enforceability?

5.1 Background

This section presents background on national circumstances regarding climate strategy and objectives, energy mix and GHG emission developments, climate policy developments as well as institutional arrangements for the UK case. Subsequently, this allows for a discussion of the findings of the UK case study while taking into account relevant national circumstances in Chapter 6.

5.1.1 Climate strategy and objectives

In 1988, then Prime Minister Margaret Thatcher delivered landmark speeches to the Royal Society and at the United Nations, addressing the issue of climate change as posing dangers to both national security and the economy. Furthermore, she supported the establishment of two of the world's leading climate research institutes, namely the Hadley Centre in 1990 and, a decade later, the Tyndall Centre. In addition, she is also known for presiding over a fierce conflict with the coal miners, culminating in the phasing out of much of the UK's coal production, followed by the privatization of the UK electricity industry in 1990 (Lorenzoni et al., 2008). This privatization, together with reduced gas prices influenced by the production of North Sea gas and improvements in electricity generation technologies, led to the so-called "dash for gas", a shift away from coal towards natural gas in electricity production (Bocse and Gegenbauer, 2017; Bowen and Rydge, 2011).

Despite the Conservative government's engagement with the issue of climate change in the mid-1990s, it was the Labour government elected in 1997 that introduced a majority of climate-related policy measures, thereby forming the basis of the UK's emission reductions strategy. The then Prime Minister Tony Blair advocated for an ecological modernization ideology and declared that ecological considerations were not contradictory to economic growth but should be seen as an opportunity for both businesses and politics, especially on the international scene (Lorenzoni et al., 2008).

In 2000, the first Climate Change Programme was published, outlining how the UK government seeks to tackle climate change and including a framework of policies and measures to reduce emissions. Overall, the Climate Change Programme aimed to enable the UK to meet its emission reduction target under the first commitment period of the Kyoto Protocol, a reduction of 12.5% between 2008 and 2012 relative to 1990 levels (Dalton, 2008). It is noteworthy that the government at the time was confident to deliver the UK's target under the Kyoto Protocol, notably due to the already achieved emission reductions resulting from the 1990s "dash for gas". In order to show leadership on climate change, the UK government further included a more ambitious domestic target in the Climate Change Programme, which aimed to reduce CO_2 emissions by 20% below 1990 levels by 2010 (Carter, 2014). However, by 2004, it became clear that the government was off track for meeting the domestic target. The Department of Environment, Food and Rural Affairs (DEFRA), at the time in charge of the environment portfolio including the issue of climate change, thus initiated a review of the Climate Change Programme in order to get the UK back on track. However, after two years of interdepartmental bargaining, the civil servants and ministers failed to agree on measures to bridge the gap. After all, the revised Climate Change Programme was published in 2006, however, it did not include sufficient steps to deliver the UK's domestic 2010 target (Rutter et al., 2012).

Alongside the Climate Change Programme, the government acknowledged in its 2003 Energy White Paper that the UK's energy policy needed major restructuring in response to ageing energy infrastructure, declining North Sea oil and gas supplies as well as climate change (Lorenzoni et al., 2008). The proposal further declares reducing CO_2 emissions, maintaining the reliability of UK energy supplies, promoting competitive markets and ensuring the affordable heating of every home as the government's main priorities regarding future energy policy. Additionally, the UK government for the first time committed to a long-term emission goal aiming to reduce CO_2 emissions by 60% below 1990 levels by 2050, which was based on recommendations by the UK Royal Commission on Environmental Pollution (Dalton, 2008).

5.1.2 Energy mix and GHG emission developments

In comparison to other European countries, the energy intensity of the UK's economy is relatively low (EEA, 2019), which is amongst other things caused by a structural shift away from energy intensive activities (such as steel making) towards low energy industries (such as services) (DBEIS, 2016). Among the EU-28 member countries the UK ranks as 2nd largest economy (The World Bank, 2018b), 16th largest emitter per capita (Eurostat, 2018c) and 2nd largest emitter in absolute terms (Eurostat, 2018b).

In the past decade, the total energy supplied in the UK has seen a declining trend, falling from a relatively stable level of about 2,500 TWh during the 1990s and early 2000s to around 2,000 TWh in 2016 (IEA, 2018). During this period, the UK's energy supply mix has also undergone substantial changes as well (see Figure 9), above all with a major shift away from coal towards natural gas (Bowen and Rydge, 2011). Overall, the share of fossil fuels remained more or less stagnant between 1990 and 2008 and amounted to around 90% of the energy supply. After 2008 the share of fossil fuels began to decline and amounted to 80% in 2016. The production of nuclear energy has seen an increase from 1990 (at around 200 TWh) to a peak around 2000 (at around 300 TWh), before declining again afterwards (back to around 200 TWh in the mid-2010s). However, the share of nuclear energy in the overall supply mix has not changed meaningfully, remaining between 8-12% over the entire period (IEA, 2018). From the early 2000s onwards, renewable energies experienced an increase from 29 TWh in 2000 (1% of total energy supply) to 194 TWh in 2016 (9%) (IEA, 2018). Nevertheless, renewable energies continue to play a relatively small role, both in regard to the UK's overall energy supply and in comparison to other OECD countries (Bowen and Rydge, 2011). As for the UK's energy dependency, the country became a net energy exporter in 1981 after the development of the production of oil and gas from the North Sea. This lasted until 2004, after the peak of North Sea production was reached in 1999, and in 2016, 35% of the energy used in the UK was imported (DBEIS, 2017b). Latest comparable data from Eurostat show that the UK had the 7th lowest level of energy dependency among EU-28 member countries (Eurostat, 2018a).

The UK's electricity production used to be largely dominated by coal, with 69% of electricity being generated from coal in 1990. This has changed substantially towards 2016 with a share of 9% coming from coal and 42% from natural gas (see Figure 10, data only available from 2000). Nuclear electricity production was relatively stable during that period and held a share of 19% in 2016. Renewable electricity production only had a share of 2% in 1990, which was then largely covered by hydropower (DBEIS, 2017a). An increase of this share towards 30% achieved in 2017 only started in 2010 and was mainly driven by the expansion of electricity production from wind and solar (DBEIS, 2018e). During the past few years the trade balance for electricity

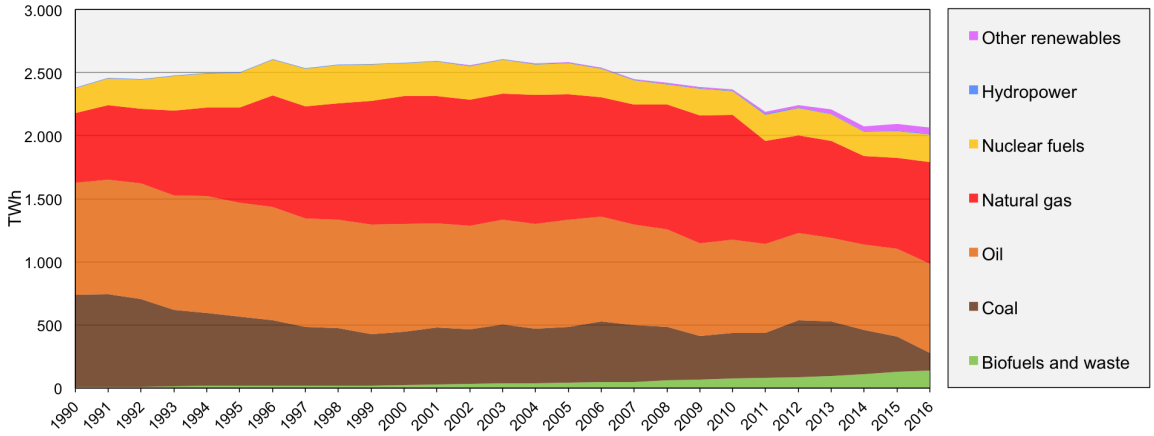

Figure 9: Total energy supply by source for the UK, 1990-2016, TWh (Data from IEA, 2018)

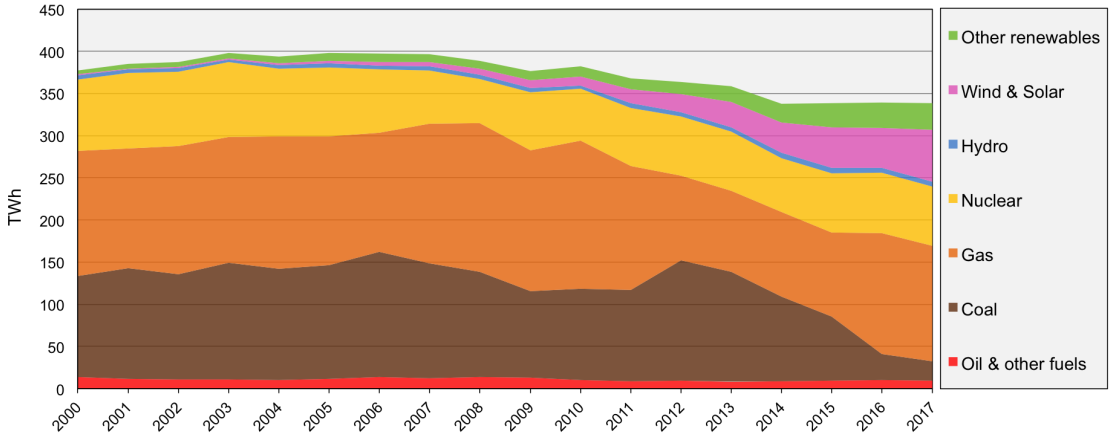

Figure 10: Total electricity production for the UK, 2000-2017, TWh (Data from DBEIS, 2018e, Excel sheet 23)

has always been negative, with net imports ranging roughly between 10 to 20 TWh per year (Eurostat, 2018e).

Latest comparable data from Eurostat show that the UK held the 5th lowest share of renewable energy in final energy consumption among EU-28 member countries with 9.3% in 2016 (Eurostat, 2018d). The renewable energy sources contributing to this relatively low share are bioenergy (72.2%), wind power (18.6%), solar power (5.5%), hydropower (2.7%) and deep geothermal as well as heat pumps (1.1%) (DBEIS, 2017b).

In 2016, total domestic emissions in the UK amounted to 482.9 $MtCO_2e$, which is a reduction by 39.6% compared to 1990 (-316.8 $MtCO_2e$). The sectors dominating UK emissions in 2016 were transport (26.0%), energy supply (24.9%) as well as

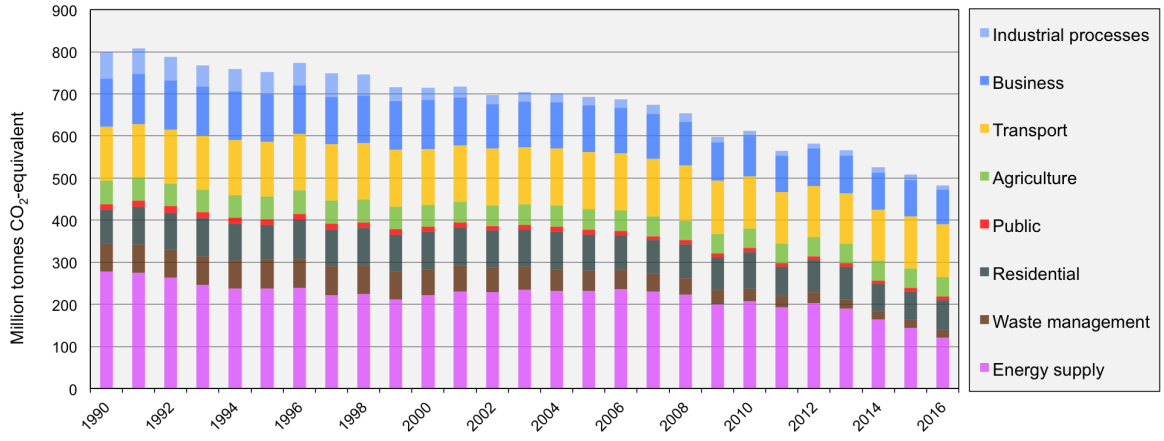

Figure 11: Total domestic GHG emissions excl. LULUCF for the UK, 1990-2016, million tonnes CO_2-equivalent (Data from DBEIS, 2018b, Excel sheet 3)

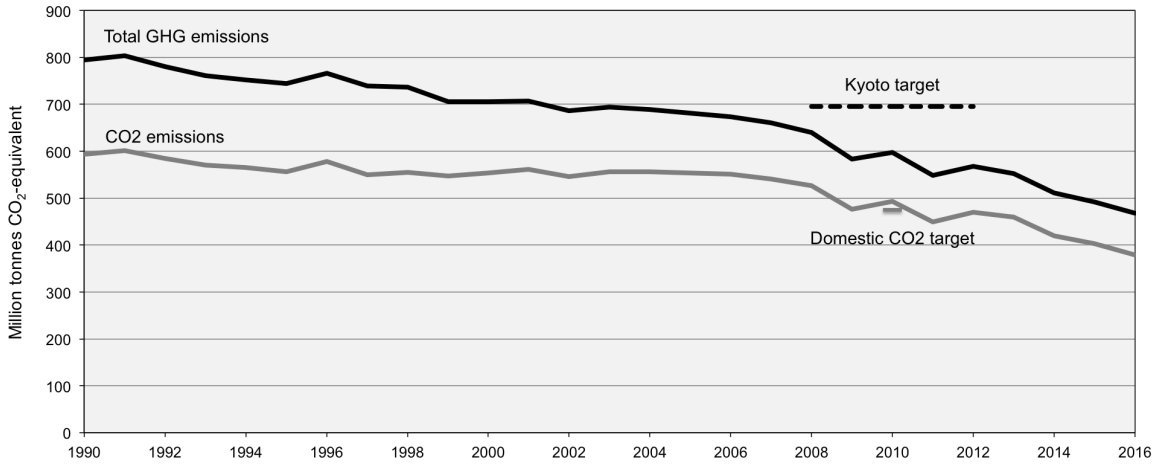

Figure 12: Total GHG and CO_2 emission development in the UK 1990-2016 compared to Kyoto target and domestic CO_2 target (Adapted from DEFRA, 2008; Data from DBEIS, 2018b, Excel sheet 3)

business and industrial processes (together 19.2%). GHG emissions from the transport sector, which historically has been the sector with the second highest emissions, have remained relatively unchanged between 1990 and 2016. However, due to strong reductions in GHG emissions from the energy supply sector, the transport sector finally became the UK's sector with the highest emissions in 2016 (DBEIS, 2018b). As for the UK's industrial base, the most relevant sectors with respect to GHG emissions are iron and steel, refineries, construction, chemicals and cement (CCC, 2018f). The remaining emissions in 2016 stemmed from agriculture (9.6%), the residential sector (14.5%), waste management (4.1%) and the public sector (1.7%). Between 1990 and 2016, the greatest absolute emission reductions have been achieved in energy supply (-157.7 $MtCO_2e$, -56.7% emission reductions within the sector) as well as

business and industrial processes (-85.6 $MtCO_2e$, -48.0% within the sectors). In addition, emissions have also been reduced in waste management (-46.7 $MtCO_2e$, -70.1% emission reductions within the sector), the residential sector (-10.3 $MtCO_2e$, -12.9% emission reductions within the sector), agriculture (-8.9 $MtCO_2e$, -16.0% emission reductions within the sector), the public sector (-5.3 $MtCO_2e$, -39.4% emission reductions within the sector) and transport (-2.4 $MtCO_2e$, -1.8% emission reductions within the sector). However, these reductions were less relevant compared to total emission reductions (see Figure 11) (DBEIS, 2018b).

The UK comfortably exceeded its emission reduction target under the first commitment period of the Kyoto Protocol by 10.5 percentage points, delivering a GHG emission reduction of 23% between 2008 and 2012 compared to 1990 levels (DBEIS, 2018a). However, the UK narrowly missed its domestic goal to reduce CO_2 emissions by 20% until 2010 compared to 1990 levels (see Figure 12). Interestingly, the UK had already reached its domestic CO_2 target in 2009 due to the economic recession, but was unable to sustain this level until 2010 as GHG emissions went back up following the economic upturn. As of 2010, only a 17% reduction in CO_2 emissions was achieved (DBEIS, 2018b).

It is noteworthy that the UK is among the OECD countries with the highest rate of decoupling of GHG emissions from GPD (see Figure 13) and experienced an increasing trend in absolute decoupling since the early 1990s (see Figure 14). For the period 1990-2000 this can be mainly attributed to the privatization of the electricity industry, and from the early 2000s, climate policies targeted at energy efficiency and emission reductions began to play a role as well (Bowen and Rydge, 2011). However, Jiborn et al. (2018) emphasize that, when looking at the UK GHG emissions from a consumption-based perspective, no absolute but only relative decoupling has been achieved.

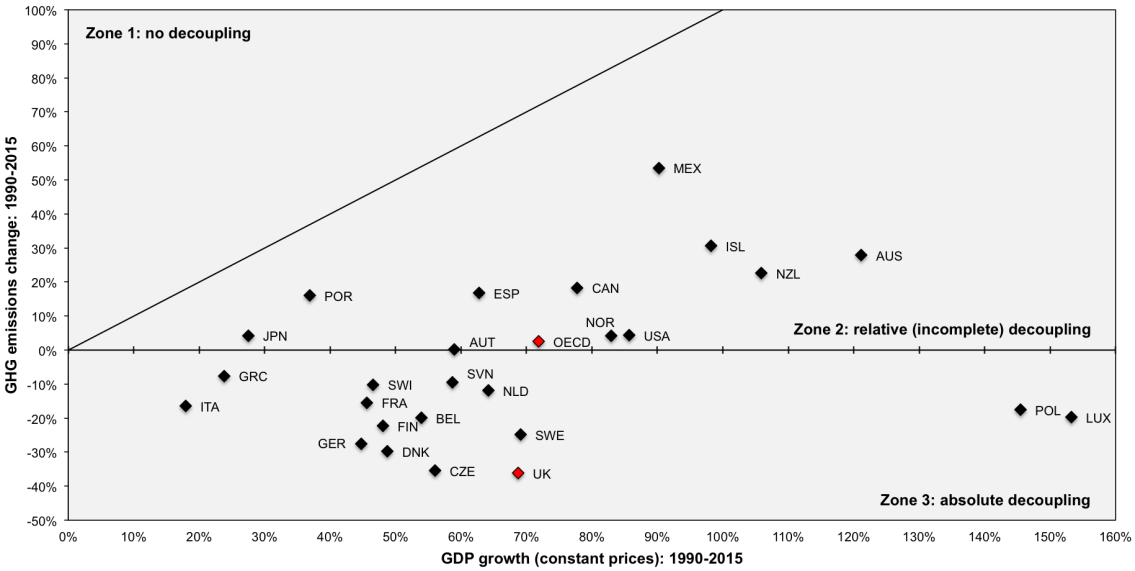

Figure 13: Decoupling of GHG emissions from GPD in the UK compared to selected OECD countries, 1990-2015 (Data from OECD, 2018a,b)

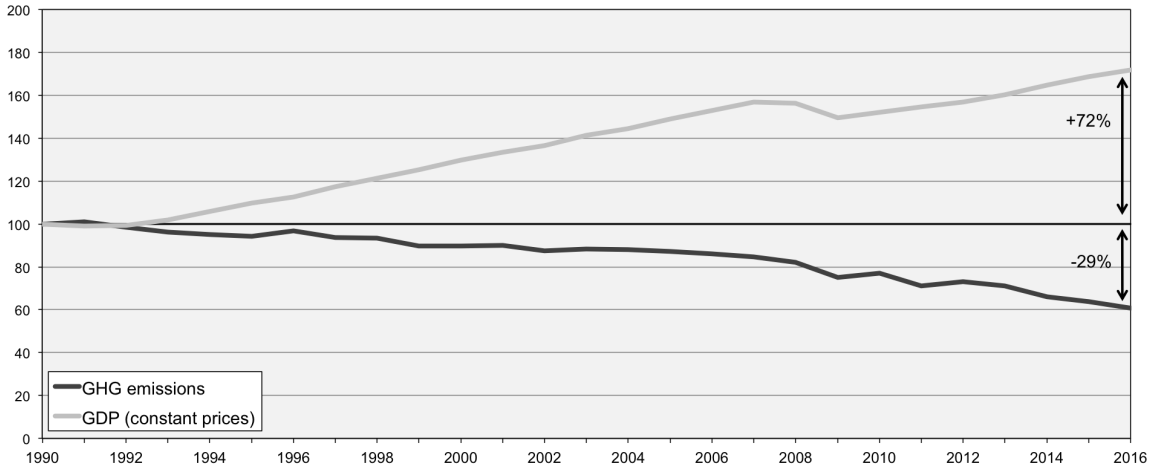

Figure 14: Decoupling of GHG emissions from GPD in the UK, 1990-2016 (Data from OECD, 2018a,b)

5.1.3 Climate policy developments

The UK began to introduce policies to reduce GHG emissions in the early 2000s (Nachmany et al., 2015), and has since then developed a broad climate policy portfolio aiming at putting a price on carbon, stimulating the development and deployment of low carbon energy as well as improving energy efficiency (Bowen and Rydge, 2011). Market-based solutions, such as feed-in tariffs, a carbon price floor and a levy on non-domestic energy use, are at the heart of UK climate policies, putting a clear focus on delivering emission reductions at the lowest possible cost (Boasson, 2013).

However, several non-marked based measures also play a role in reducing emissions. Legislation, such as building regulations, product policies and limits on pollutant emissions from industrial installations, as well as information activities, such as labeling requirements for energy efficiency and the role-out of smart meters, have been introduced as well (DBEIS, 2017a). Furthermore, the transposition of EU directives into national law forms an important part of climate policy in the UK (Nachmany et al., 2015). Most notable is the EU ETS, which comprises around 1,000 installations within industry and energy production in the UK (DBEIS, 2018c), accounting for 31% of the UK's total emissions in 2016 (equaling 147 $MtCO_2e$) (EEA, 2018). In this context it is noteworthy that the UK introduced a carbon price floor in 2013. This price floor targets fossil fuels used to generate electricity and aims at countering the relatively low price of carbon in the EU ETS as well as reducing the risk of investments in low-carbon technologies. Initially the price floor was set at GBP16 per tonne, increasing to GBP30 per tonne in 2020. However, this increase was cancelled in March 2014, freezing the price floor at GBP18 per tonne from April 2016 for the rest of the decade (DBEIS, 2017a; Nachmany et al., 2015).

With regard to low-carbon electricity generation, the non fossil fuel obligation was established under the Electricity Act of 1989, initially to support electricity generation from nuclear energy, although the scope was expanded in 1990 to include renewables. In 2002, the non fossil fuel obligation was replaced by the renewables obligation, which has since then been the main market-based mechanism to support large-scale renewable electricity generation, and requires electricity suppliers to source a specific share of their sales from renewable sources, or pay a fine. As of 2017, the renewables obligation has closed to new capacity, although existing facilities continue to be supported until 2037, and has been superseded by contracts for difference. These are long-term contracts between the government and electricity suppliers to provide stable and predictable conditions in order to encourage investing in low-carbon large-scale electricity generation with high upfront costs and long lifetimes, including renewables, nuclear as well as carbon capture and storage. Turning to small-scale renewable electricity generation, feed-in tariffs are available since 2010 in order to support households, businesses and communities. These tariffs vary depending on the technology, and last between 10 and 25 years. Moreover, to ensure security of electricity supply, especially to meet peak demand, a capacity market was introduced in 2017, which provides regular payments to capacity providers. In return, these must be ready to produce electricity or reduce demand if needed by the electricity system (Bowen and Rydge, 2011; Nachmany et al., 2015). Regarding district heating, the heat networks investment project was introduced in 2017, providing grants and loans to support the expansion of district heating networks in the UK (DBEIS, 2017a).

Affecting both the energy supply and industry sector, limits on pollutant emissions from industrial installations, i.e. sulfur dioxide, nitrogen oxides and dust in combustion plants, were initially set in 2007 based on the Large Combustion Plant Directive. In 2016, this directive has been replaced by the Industrial Emissions Directive, which includes more stringent provisions (DBEIS, 2017a). Further measures in the industry and business sector include the energy savings opportunity scheme, which builds on the Energy Efficiency Directive, and aims to support large enterprises to identify cost-effective energy efficiency measures by requiring them to measure their total energy consumption and carry out energy audits (DBEIS, 2017a; Nachmany et al., 2015). Moreover, a climate change levy was introduced in 2001 covering electricity, gas, solid fuel and liquefied gases used for lighting, heating and power in the industry and business sector as well as the public sector, although renewable electricity producers and CHP facilities were exempt from the levy until 2015. The climate change levy effectively replaced the fossil fuel levy, which was introduced in 1989 and taxed suppliers of fossil electricity production. Additionally, climate change agreements allow energy intensive industries to receive a discount from the climate change levy when meeting energy efficiency or carbon saving targets (Bowen and Rydge, 2011; Nachmany et al., 2015). Furthermore, the carbon reduction commitment energy efficiency scheme launched in 2010 established a UK-wide mandatory emissions trading scheme for large public and private sector organizations. The scheme targets large users of energy outside the EU ETS as well as outside of climate change agreements and aims to improve energy efficiency using three drivers: information, as it increases awareness of the internal energy use, reputational, as the aggregated emission data of the organization are published, and financial, as the organizations are required to buy allowances for the emissions caused by their energy use. In addition, the non-domestic renewable heat incentive provides grants to the industry and business sector, the public sector as well as non-profit organizations to support the installation of renewable heat installations since 2011. Finally, the issue of F-gas emissions is mainly addressed through EU legislation (DBEIS, 2017a).

A number of policy measures target energy efficiency and energy use in buildings, which are relevant to the industry, business, public, as well as the residential sector. Building regulations define minimum energy performance standards for new and renovated buildings since 2002, while the energy efficiency of buildings is recorded on a scale form A to G in energy performance certificates, based on the Energy Performance of Buildings Directive introduced. Furthermore, any property which is rented out in the private rented sector after April 2018 is required to have a minimum Energy Performance Certificate rating of E. Additionally, the smart metering program initiated in 2012 aims to provide real time information on energy use and thus encourage energy savings in domestic properties. Regarding the energy use of products, the Ecodesign Directive and the Energy Labeling Framework Directive set standards for minimum performance and information requirements of energy using

products, in order to increase the energy efficiency of products and inform consumers (DBEIS, 2017a).

Further relevant policies for the residential sector include the domestic renewable heat incentive, which, similarly to its non-domestic counterpart, provides grants supporting the installation of renewable heat installations since 2014. Earlier, the renewable heat premium scheme provided cash back vouchers for households to incentivize switching to renewable heating installations from 2011 to 2014 (DBEIS, 2017a). Furthermore, several policy measures targeted domestic energy efficiency. First, the energy efficiency commitment, which ran from 2002 until 2008, required energy suppliers to achieve energy savings through supporting their costumers with home energy efficiency improvements. This scheme was replaced by the carbon emission reduction target, which ran from 2008 to 2012 and focused more on substantial and robust household energy saving measures (e.g. improved insulation). The carbon emission reduction target was further complemented by the community energy saving program, which ran from 2009 to 2012 and focused on households affected by fuel poverty. Subsequently, both the carbon emission reduction target and the community energy saving program were succeeded by the energy company obligation and the green deal in 2013. Similar to its predecessors the energy company obligation continued to require energy suppliers to achieve energy savings through promoting energy efficiency improvements, in particular in support of vulnerable and low-income households. Moreover, the green deal enabled borrowing money to fund energy efficiency improvements for households, which could be paid back using the savings of the energy bills. However, the green deal did not attract as much interest as expected, and in 2015 the government decided to not further fund the scheme, although the framework stayed in place for existing green deal plans and to give private finance providers the possibility to enter the market (Bowen and Rydge, 2011; DBEIS, 2017a; Nachmany et al., 2015).

In the transport sector, the renewable transport fuels obligation, introduced in 2007 in fulfillment of the EU Renewables Directive, requires suppliers of transport fuels to ensure a certain share of their sales comes from renewable sources (Bowen and Rydge, 2011; Nachmany et al., 2015). Moreover, CO_2 emission performance standards for new vehicles are in place based on EU regulations. In addition, a graduated vehicle excise duty based on the level of CO_2 emissions and a graduated company car tax incentivizing company cars with lower CO_2 emissions are in place since 2001 and 2002 respectively. Furthermore, investment grants have become available to support the purchase of plug-in ultra-low-emission vehicles since 2011, as well as for the installation of charging infrastructure in homes, at workplaces and along roads since 2016. Regarding rail infrastructure, investments are being made to increase the electrification rate across the network since 2013. Finally, the local sustainable transport

fund supports investments by local governments to promote public transport, cycling and walking since 2011 (DBEIS, 2017a).

The waste management sector is influenced heavily by EU legislation, e.g. by the Waste Framework Directive, which provides general requirements for waste management, the Landfill Directive, which sets out goals to reduce landfilling of organic waste, and the Waste Incineration Directive, which aims to reduce pollution from waste incineration. In addition, the UK introduced a landfill tax in 1996. Furthermore, the production of heat from the incineration of waste is financially supported through the non-domestic renewable heat incentive, based on the proportion of biomass in the waste (DBEIS, 2017a).

As for agriculture, relatively few policy instruments directly targeting GHG emissions are in place, however, measures aiming at improving water quality and biodiversity as well as protecting soils often result in co-benefits for reducing GHG emissions. In this context, policies targeting nitrous oxide emissions, such as the nitrates action plan in fulfillment of the Nitrate Directive (2013) or catchment sensitive farming (2006) are relevant to GHG emission mitigation as well. Moreover, the Rural Development Program under the Common Agricultural Policy of the EU is also relevant with regard to climate change mitigation, as it supports measures providing non-profitable services to the wider public e.g. through improved manure handling or more efficient use of nitrogen. In addition, the agri-tech strategy (2014) supports technologies contributing to agricultural efficiency and the agricultural action plan (2010) sets out land management measures to reduce emissions (DBEIS, 2017a).

With regard to forestry, woodland creation is supported under the EU Rural Development Program, as well as through the woodland carbon fund and woodland creation planning grants, which provide public investments, and the woodland carbon code and the Grown in Britain initiative, which aim to attract private funding. Sustainable forestry management is standardized in the UK forestry standard, stipulating that forest management should in the long run contribute to climate change mitigation through net capture and storage of carbon. In this context, felling and deforestation is regulated in the UK Forestry Act (DBEIS, 2017a).

The UK's exit from the European Union poses several potential challenges for the country's climate policy, such as the loss of EU legislation, recourse to EU institutions and various sources of funding (Farstad et al., 2018). The Committee on Climate Change (CCC) estimates that about 40% of UK emission reductions since 1990 stem from EU policies, which further cover about half of the UK's potential emission reductions to 2030 (CCC, 2016a). The absence of EU directives also means that investment stability for UK businesses may be reduced, as climate policies become more dependent on domestic electoral cycles. Additionally, the ability of the UK to reach emissions targets may be weakened due to the loss of access to the EU ETS

as well as the internal energy market. The lack of access to a larger market for emission allowances may also have negative effects on UK companies with regard to cost-efficiency. Finally, the UK may also suffer from a significant loss of influence over international and EU climate policy (Farstad et al., 2018).

Ultimately, it is important to note that in the UK several climate-related matters are devolved to the Scottish Government, the Welsh Government and the Northern Ireland Executive (DBEIS, 2017a). This case study analysis nonetheless focuses primarily on the central UK government.

Table 4 summarizes existing climate-related policy measures in the UK divided by sectors and indicates the starting year of their implementation. Additionally, EU-regulated policy measures are marked in blue.

Table 4: Existing climate-related policy measures in the UK divided by sectors (Adapted from DBEIS, 2017a, p 82ff)

Energy supply	
Renewables obligation	2002
EU ETS	2005
Feed in tariffs	2010
Limits on pollutant emissions from industrial installations – based on Industrial Emissions Directive (2010/75/EU)	2016
Capacity mechanism	2014
Contracts for difference	2014
Carbon price floor	2013
Heat networks investment project	2017
Industry and business	
EU ETS	2005
Limits on pollutant emissions from industrial installations – based on Industrial Emissions Directive (2010/75/EU)	2016
Building regulations	2002
Products policy – based on Ecodesign Directive (revised 2009/125/EC) and Energy Labeling Directive (2010/30EU)	2008
Renewable heat incentive	2011
Smart metering	2012
Carbon reduction commitment energy efficiency scheme	2010
Climate change levy	2001
Energy performance certificates for buildings – based on Energy Performance of Buildings Directive (2010/31/EC)	2007
Private rented sector energy efficiency regulations	2016
Climate change agreements	2001
Energy savings opportunity scheme – based on Energy Efficiency Directive (2012/27/EU)	2014
Ozone depleting substances regulation – based on EU regulations 2037/2000/EC and 1005/2009/EC	2001
Fluorinated GHG regulation – based on MAC Directive (2006/40) and EU regulation 842/2006	2007
F-gas regulation 2014 – based on EU regulation 517/2014/EC	2015
Public sector	
EU ETS	2005
Building regulations	2002
Products policy - based on Ecodesign Directive (revised 2009/125/EC) and Energy Labeling Directive (2010/30EU)	2008
Renewable heat incentive	2011
Carbon reduction commitment energy efficiency scheme	2010
Climate change levy	2001
Energy performance certificates for buildings – based on Energy Performance of Buildings Directive (2010/31/EC)	2007
Public sector energy efficiency loans scheme	2004

Residential sector	
Building regulations	2002
Products policy – based on Ecodesign Directive (revised 2009/125/EC) and Energy Labeling Directive (2010/30EU)	2008
Renewable heat incentive	2011
Smart metering	2012
Energy company obligation	2013
Energy performance certificates for buildings – based on Energy Performance of Buildings Directive (2010/31/EC)	2007
Private rented sector energy efficiency regulations	2016
Fluorinated GHG regulation – based on MAC Directive (2006/40) and EU regulation 842/2006	2007
Transport	
Rail electrification	2013
Renewable transport fuel obligation – based on EU Renewables Directive (2009/28/EC)	2007
Car fuel efficiency policies – based on EU regulations 443/2009 and 661/2009	2012
Van fuel efficiency policies – based on EU regulations 510/2011 and 661/2009	2012
Heavy goods vehicles fuel efficiency policies – based on EU regulation 661/2009	2012
Local sustainable transport fund	2011
Grants for plug-in ultra-low-emission vehicles	2011
Graduated vehicle excise duty	2001
Graduated company car tax	2002
Workplace charging scheme	2016
Electric vehicle home charge scheme	2016
On-street residential chargepoint scheme	2016
Waste	
Waste measures – based on Waste Framework Directive (2008/98/EC), Landfill Directive (1999/31/EC), Waste Incineration Directive (2000/76/EC) and the UK landfill tax (1996)	N/A
Agriculture	
Agricultural action plan	2010
Agri-tech strategy	2014
Nitrates action plan – based on Nitrate Directive (91/676/EEC)	2013
Catchment sensitive farming	2006
Environmental stewardship (support under 2nd pillar of Common Agricultural Policy CAP)	2005
Land use, land use change and forestry (LULUCF)	
Woodland carbon code	2011
Woodland carbon fund	2016
Revised UK forestry standard	2017
Forestry Act, felling license regulations and environmental impact (forestry) regulations	1999
Grown in Britain	2013
Grant aid for afforestation (EU co-financed through Rural Development Program)	2007
Woodland creation planning grants	2015

In the following, connections between the energy mix and emission developments explained in Section 5.1.2 and the climate policy developments described above are established.

First, emissions in the energy supply sector have been halved since 1990, mainly because of a switch from coal towards gas in electricity generation, i.e. the so-called "dash for gas". However, this development was not a result of specific climate policy measures, but as explained in Section 5.1.1, can rather be attributed to the phasing out of coal mining in the UK, the start of the production of North Sea gas, and privatizations in the energy industry (Bocse and Gegenbauer, 2017; Bowen and Rydge, 2011; DBEIS, 2017a). Although there has to some extent also been a shift from coal towards renewables in electricity production, this trend is not very significant in comparison to the "dash for gas" (DBEIS, 2018e). It can be argued that this is calling into question the effectiveness of UK policies to promote renewable electricity generation, such as the renewables obligation, contracts for difference and feed-in tariffs.

Second, the developments relating to the "dash for gas" also affected the business and industry sectors, which similarly experienced a fuel shift away from coal to gas. Together with energy efficiency gains and a structural shift in the UK economy towards the service sector, this contributed to a reduction of GHG emissions by almost 50% in these sectors since 1990 (DBEIS, 2017a). Again these trends are not a result of policy measures directly aiming at climate change mitigation, except for energy efficiency gains, which arguably can be attributed to policies measures such as the climate change agreements, the carbon reduction commitment energy efficiency scheme and the energy savings opportunity scheme.

Third, emissions from waste management decreased strongly, due to a reduction of landfilling of untreated waste as well as increased recycling. This trend can mainly be attributed to the introduction of a landfill tax. Furthermore, the diversion of waste away from landfills towards incineration caused the waste management sector to become an important electricity producer, with a share of about 14% of UK renewable electricity generation in 2015 (DBEIS, 2017a).

Fourth, emissions in the residential sector have also been reduced, which can mainly be attributed to a decrease in energy consumption of households since 1990. This was a result of a range of energy efficiency policies put in place, such as tighter building and product standards (e.g. better boilers and insulation), as well as obligations on energy suppliers to achieve energy savings through supporting the implementation of home energy efficiency improvements, i.e. under the energy company obligation scheme and its predecessors (DBEIS, 2017a).

Fifth, emissions from domestic transport have remained relatively unchanged between 1990 and 2016 (DBEIS, 2018b). Although energy efficiency of cars in the UK has increased by about 16% between 2000 and 2015, this was counteracted by an increase of overall traffic volume (DBEIS, 2017a).

Finally, emission reductions in agriculture have been achieved mainly due to a reduction in the number of animals and a decrease in the use of mineral fertilizers (DBEIS, 2018b). However, no clear connections between these trends and specific climate policy measures can be identified.

5.1.4 Institutional arrangements

In the UK, the primary responsibility for climate change issues lies with the Department for Business, Energy and Industrial Strategy (DBEIS), which is in charge of ensuring secure, clean and affordable energy as well as promoting action on climate change in the UK and internationally (DBEIS, 2017a). This reflects a clear strategic choice of combining government responsibility for emission reductions with energy and not environmental policy (Fankhauser et al., 2018). Additionally, responsibility for some climate policy measures is further spread and falls within other ministerial portfolios (DBEIS, 2017a). As such, the following ministries play a key role in the UK's climate policy:

- Department for Business, Energy and Industrial Strategy (DBEIS): responsible for e.g. renewables obligation, feed in tariffs, capacity mechanism, contracts for difference, carbon price floor, products policy, renewable heat incentive, smart metering, carbon reduction commitment energy efficiency scheme, climate change levy, energy company obligation, private rented sector energy efficiency regulations, public sector energy efficiency loans scheme, climate change agreements, energy savings opportunity scheme, heat networks investment project
- Department of Environment, Food and Rural Affairs (DEFRA): responsible for e.g. limits on pollutant emissions from industrial installations, agricultural action plan, agri-tech strategy, nitrates action plan, catchment sensitive farming, environmental stewardship, waste measures, ozone depleting substances regulation, F-gas regulations
- Department for Transport: responsible for e.g. rail electrification, renewable transport fuel obligation, car fuel efficiency policies, van fuel efficiency policies, heavy goods vehicles fuel efficiency policies, local sustainbale transport fund, plug-in grants for ultra-low emission vehicles, graduated vehicle excise-duty, graduated company car tax, workplace charging scheme, electric vehicle home charge scheme, on-street residential chargepoint scheme
- Ministry of Housing, Communities and Local Government: responsible for e.g. building regulations and energy performance certificates for buildings

- Forestry Commission[8]: responsible for e.g. woodland carbon code, woodland carbon fund, revised UK forestry standard, Forestry Act, felling license regulations, environmental impact regulations concerning forestry, Grown in Britain, grant aid for afforestation (EU co-financed through Rural Development Program) and woodland creation planning grant (DBEIS, 2017a)

DBEIS was formed following Theresa May's appointment as Prime Minister in July 2016, resulting from the merger of the Department of Energy and Climate Change (DECC), which had the main responsibility regarding climate policy-making since 2008, and the Department for Business, Innovation and Skills. The abolishment of DECC has received mixed feedback, with some perceiving it as a major setback as it signals a downgrading of climate change on the government's agenda. Others however argue that bringing energy and climate change issues together with industrial strategy could potentially create a strong platform for decarbonization of the UK economy (Weeks, 2017). Additionally, a stronger department might in contrast to a more specialized department be more capable of integrating climate change issues across sectors of government (Church, 2016).

At present, climate change policy at civil servant level is coordinated by interdepartmental committees chaired by DBEIS, while decisions at ministerial level are taken by a Cabinet Committee chaired by the Chancellor of the Exchequer (DBEIS, 2017a). Such Cabinet Committees allow collective decisions to be taken by a smaller group of ministers and thus aim to reduce the burden on Cabinet (Cabinet Office, 2018). However, strong action on climate change across sectors of government is hampered by the UK's structure of Cabinet Government, as it lacks a coherent system of policy coordination that prioritizes climate change as a strategic economic, social, environmental and institutional issue (Lorenzoni et al., 2008).

5.2 UK Climate Change Act (UK CCA)

The UK CCA was the product of several factors coming together. Key driving forces behind establishing the Climate Change Bill and ultimately the UK CCA were the Friends of the Earth campaign (called the Big Ask), intense party political competition, leadership within government and the influence of expert reports (in particular the Stern Review) (Weeks, 2017). In April 2005, a bill demanding legally binding annual emission reductions was drafted by civil society groups led by Friends of the Earth, who subsequently advocated to get it introduced in parliament by a cross-party group of members of parliament. This was followed by the "Big Ask" campaign of Friends of the Earth, promoting this aim to the wider public (Benson and Loren-

[8]The Forestry Commission is a non-ministerial department under DEFRA. In the UK, non-ministerial departments are government departments in their own right, but they do not have their own minister and are usually headed by senior civil servants (Rutter, 2013).

zoni, 2014). In September 2006, Friends of the Earth's Executive Director Tony Juniper shared a platform with David Cameron, which was a major political success for Friends of the Earth, as the then new leader of the Conservative opposition announced his support for the "Big Ask" campaign. Ultimately, the "Big Ask" campaign gained the support of 412 out of 612 MPs for a parliamentary early day motion. Shortly thereafter the government had as well announced its support for a climate bill (Carter and Childs, 2017). Clearly, intense party political competition on climate change between the Labour government and the Conservative opposition contributed to the success of the "Big Ask" campaign in gaining cross-party support for climate change legislation (Rutter et al., 2012). Specifically, David Cameron's decision of emphasizing environmental concerns as new signature issue in an attempt to modernize the Conservative Party is considered to have been a major catalyst (Carter, 2014). This competitive consensus among the major parties prevented weakening of key provisions of the Climate Change Bill, which were conversely even strengthened as the bill went through parliament (Fankhauser et al., 2018).

Besides the influence of party politics, the leadership of individuals within government played a key role in establishing the UK CCA as well. In May 2006, David Miliband became Secretary of State for DEFRA and wanted to make a quick impact to support his potential future bid as leader of the Labour Party (Carter, 2014). This included setting up a new cross-departmental Office of Climate Change in September 2006 to promote the consideration of climate change issues and provide ministers with a shared analysis in order to avoid interdepartmental conflicts. Moreover, Bryony Worthington, who was a campaigner at Friends of the Earth involved in the "Big Ask" campaign, was brought into government and played an important role in drafting the bill (Rutter et al., 2012). Furthermore, influential expert reports provided additional credibility and momentum for action on climate change. First, the landmark Stern review in 2006, discussing the economics of climate change, showed that inaction would be far more costly compared to the costs of action to mitigate climate change. Second, the IPCC's fourth assessment report in 2007 indisputably concluded that the climate system was warming and quantified the probability of human activities (principally burning fossil fuels and land use change) as a cause of such global warming to be greater than 90% (Hill, 2009).

The Labour government published a draft Climate Change Bill in March 2007, which was subject to pre-legislative scrutiny, including public consultation and consideration by parliamentary committees, after which it was introduced to parliament in November 2007 (Hill, 2009). During the legislative process, public campaigning by civil society groups continued to play a key role in strengthening the act (Carter and Childs, 2017). Ultimately, the bill was passed through parliament with a remarkable near unanimous vote in favor at its third reading in the House of Commons (Ayes 463, Noes 3), leading to the UK CCA receiving royal assent and becoming law in

November 2008 (Weeks, 2017). It is considered as rather unlikely that the same act with the same level of unanimity could have passed at any other point in time over the past ten years (Fankhauser et al., 2018).

The UK CCA has three central pillars: first, a legally binding long-term 2050 emission reduction target (see Section 5.2.1), with corresponding five-yearly carbon budgets as stepping stones towards the long-term target (see section Section 5.2.2); second, a series of reporting activities required by the government (see Section 5.2.3), including bringing forward policies and proposals to meet the carbon budgets and long-term target and a framework to ensure steps are taken for climate change adaptation; and third, the formation of an independent committee to advise the government and monitor progress (see section Section 5.2.4) (Hill, 2009). The purpose of the UK CCA and thereby the rationale behind climate change legislation is outlined by the government's draft Climate Change Bill as follows:

- "*to demonstrate leadership by example to help foster collective international action*
- *to create a clear and coherent framework to enable the UK to meet domestic and international commitments*
- *to provide greater clarity and certainty for UK industry, households and individuals to effectively plan for and invest in a low carbon economy*
- *to maximize social and economic benefits and minimize costs to the UK as we pursue these goals*
- *to help the UK towards being better adapted to the impacts of unavoidable climate change*" (HM Government, 2007, p 18).

The core duties under the UK CCA apply to the Secretary of State, referring to a Cabinet Minister in charge of the government department responsible for the issues at hand (Hill, 2009). Currently, the primary responsibility for climate change issues within the UK government lies with DBEIS, together with DEFRA, which leads on domestic adaptation policy (DBEIS, 2017a). However, the duties placed on the Secretary of State are clearly not attainable in isolation, rather they require the Secretary of State to steer a wide range of governance actors as best as he or she can in order to accomplish the specified outcomes (Muinzer, 2018). Certain powers and responsibilities established under the UK CCA also apply to the devolved administrations of Scotland, Wales and Northern Ireland (e.g. the power to request the advice of the CCC). In addition, the Secretary of State must consult with the devolved administrations on several matters under the act (e.g. setting or alteration of the 2050 target as well as carbon budgets). Scotland has also passed its own subnational climate change legislation, the Climate Change (Scotland) Act 2009 (Hill, 2009; Muinzer, 2018). This case study analysis nonetheless focuses primarily on the role of the central UK government and parliament in implementing the UK CCA.

Overall, the core philosophy of the act is the creation of transparency, accountability and political pressure to ensure that governments will comply, which shall be achieved through a range of built-in duties, actions and reporting requirements, combined with the advisory and monitoring function of the independent committee as well as the scrutiny role of parliament. It is considered that compliance with the legislation is therefore ensured through institutional and political means, rather than containing a legal enforcement mechanism. In theory, the obligations under the act are legally binding and enforceable by the courts through judicial review due to their statutory basis (Hill, 2009). In practice however, this matter is not straightforward. Whilst non-compliance with the procedural duties of the act (such as reporting or consultation obligations) would be judicially reviewable, the legal enforceability of the substantive duties (such as meeting reduction targets or carbon budgets) is more uncertain and subject to debate (Church, 2015; Macrory, 2014; Muinzer, 2018; Reid, 2012). Although the government's intention when formulating the act aimed for the substantive duties to be enforceable in the courts, potential obstacles to judicial enforcement of these duties exist, such as the difficulty of finding an effective and appropriate remedy (Weeks, 2017).

In December 2017, a civil society group called Plan B commenced legal action against the government, requesting permission to seek a judicial review of the government's failure to revise the 2050 target to comply with the Paris Agreement (Fankhauser et al., 2018). Plan B argues that the 2050 target should be made more ambitious, taking the Paris Agreement's ambition to limit average warming to well below 2°C and striving for 1.5°C into consideration (Sabin Center for Climate Change Law, 2017). The claimants are thus seeking declaratory relief that the government has violated responsibilities under the UK CCA, and aim for a binding order to the Secretary of State to amend the 2050 target (Muinzer, 2018). After the High Court ruled in July 2018 that there would not be a full hearing on the case, Plan B turned to the Court of Appeals. Ultimately, the Court of Appeal rejected Plan B's appeal to have their case heard in January 2019 (Plan B, 2019). Nevertheless, the ambition of the 2050 target has been increased as of June 2019 (more details are provided in Section 5.2.1).

5.2.1 Emission targets

The central provision of the act is section 1.1, which states: *"it is the duty of the Secretary of State to ensure that the net UK carbon account for the year 2050 is at least 80% lower than the 1990 baseline"* (The Climate Change Act 2008, 1.1). This provision places a legal duty on the government to achieve an 80% reduction of the UK's GHG emissions compared to 1990 levels by 2050. Initially, a 2050 target of at least 60% was included, which was increased to at least 80% following the advice of the CCC, which was requested to provide early advice to the government on the level

of the 2050 target after its establishment in shadow form while the bill was being considered in parliament. The reduction in GHG emissions demanded by the 2050 target may be achieved both through measures taken in the UK and abroad (Hill, 2009). However, the government has a duty under the act to consider the need for UK domestic action on climate change in relation to both the 2050 target and the carbon budgets (The Climate Change Act 2008, 15.1.a).

The performance against emission targets and carbon budgets under the UK CCA is measured with respect to the net UK carbon account (Hill, 2009). In general, emissions of all the main GHGs (CO_2, methane, nitrous oxide and F-gases) and from all domestic sources are included in the net UK carbon account, although emissions from international aviation and international shipping are excluded until regulations are made for such emissions to be considered as emissions from UK sources (The Climate Change Act 2008, 24,29 and 30.1). The basis for calculating the net UK carbon account is defined in section 27 of the act (The Climate Change Act 2008, 27), and displayed in Figure 15. The actual UK GHG emissions form the starting point, which is then adjusted to account for removals by carbon sinks associated with LULUCF activity, which corresponds to the net UK emissions. These are then further adjusted to take into account the trade of carbon units under the EU ETS, considering those that have been brought into the UK to offset emissions, which thereby reduce the net UK carbon account, as well as UK carbon units that have been sold outside the UK, which thereby increase the net UK carbon account as the receiver can count these units towards offsetting their own emissions (DBEIS, 2019a). Using the net carbon account basis implies that emissions for sectors covered by the EU ETS (mainly including the power sector and energy intensive industry) are based on the UK's share of the EU ETS cap, instead of the actual emissions in those sectors, which allows the UK extra flexibility by using EU ETS trading (Weeks, 2017). Overall, the net carbon account basis is a potential source of confusion as well, given that important developments, such as the progress made in decarbonizing electricity generation, are not directly reflected (Fankhauser et al., 2018).

The act allows for the 2050 target to be amended, but only under certain circumstances i.e. significant developments in either scientific knowledge about climate change or in European or international law or policy (The Climate Change Act 2008, 2.2.a). An amendment is performed through secondary legislation, which is by order of the Secretary of State, but is subject to the affirmative resolution procedure, requiring formal approval of both the House of Commons and House of Lords (Weeks, 2017). Before introducing a draft order to parliament regarding an amendment of the 2050 target, the government must follow certain procedures, including obtaining and considering the advice of the CCC (The Climate Change Act 2008, 3.1). If the government decides to set the target at a different level from that recommended by

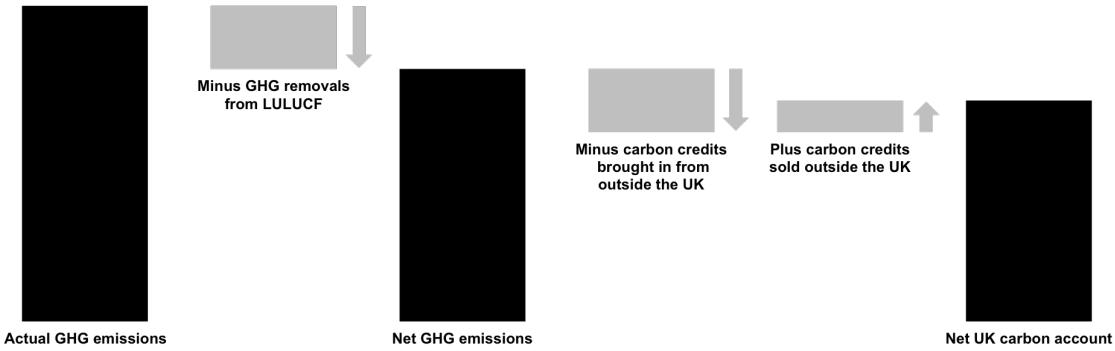

Figure 15: Calculating the net UK carbon account (Adapted from DBEIS, 2019a, p 3)

the CCC, it must publish a statement explaining the reasons for that decision (The Climate Change Act 2008, 3.6).

In light of the Paris Agreement, it has been questioned if the 2050 target is still sufficient, as the latter was set related to a global objective of maintaining around a 50% chance of limiting a global mean temperature increase to below 2°C. However, the Paris objective is more ambitious, aiming for a temperature rise well below 2°C and striving for 1.5°C. Furthermore, no provisions equivalent to the Paris Agreement's objective of net-zero emissions before the end of this century are included in the act, which currently stops in 2050 (Fankhauser et al., 2018). The CCC advised the government in 2016 to not yet alter the original 2050 target, but keep a net-zero target under review (CCC, 2016b). As a crucial report from the IPCC was not expected before late 2018, the CCC felt that an informed decision was not feasible due to the evolving evidence base (Fankhauser et al., 2018). Shortly after the publication of the IPCC special report on the impacts of global warming of 1.5°C in October 2018, the government asked the CCC to provide advice on setting a date for achieving net-zero emissions, the implications for the original 2050 target, how such reductions can be achieved and the costs and benefits involved in comparison to existing targets (DBEIS, 2018d). In March 2019, the CCC published its advice, recommending to legislate a new long-term target aiming at net-zero by 2050 (CCC, 2019a). In one of her last act's as prime minister Theresa May announced in mid June 2019 the setting of a legally binding net-zero target by 2050 (Carbon Brief, 2019). By the end of June 2019, a statutory order amending the original 2050 target from 80% to 100% emission reductions entered into force (The Climate Change Act 2008 (2050 Target Amendment) Order 2019). This 100% emission reduction target corresponds to a net-zero target, since the UK CCA allows to offset emissions through removals

of GHGs from the atmosphere as well as to a certain extent the use of international carbon credits.

In addition to the 2050 target, the act also contains an interim GHG emissions reduction target for 2020, which forms part of the carbon budgeting process. Section 5.1.a of the act requires that the carbon budget which encompasses the year 2020 needs to be planned in a way to ensure that the annual equivalent of the carbon budget for the period is at least 34% lower than the 1990 levels (The Climate Change Act 2008, 5.1.a). It is noteworthy that the 2020 target was increased in early 2009 based on recommendations of the CCC, from initially 26% to 34%. The procedure and conditions for amending the 2020 target are similar to what has been described above in regard to the 2050 target (Hill, 2009). Overall, the 2020 target has not had any notable influence on the debate and is now replaced by the fourth carbon budget covering the year 2020 (Fankhauser et al., 2018). In addition to its national emission targets, the UK has also committed to a 16% emission reduction by 2020 under the EU Effort Sharing Decision as well as to a 37% reduction by 2030 under its successor the EU Effort Sharing Regulation. Both commitments apply to emissions not covered by the EU ETS compared to 2005 levels (EC, 2018a,b). This suggests that the UK's national emission targets are more ambitious than its obligations under EU legislation.

5.2.2 Carbon budgets

In addition to the 2050 target, the act introduces a system of five-yearly carbon budgets, which provide a statutory cap on economy-wide GHG emissions over the respective period and function as stepping stones towards the 2050 target (Fankhauser et al., 2018). The government has a legal duty under the act to ensure that the net UK carbon account for a given budgetary period does not exceed the level of the carbon budget (The Climate Change Act 2008, 4.1.b). The first three carbon budgets (2008-2012, 2013-2017 and 2018-2022) were required to be set before 1st June 2009 (The Climate Change Act 2008, 4.2.a). Subsequent carbon budgets must be set no later than 30th June in the 12th year before the beginning of the period in question (The Climate Change Act 2008, 4.2.b). For example, the sixth budget for 2033-2037, which is the next budget to be fixed, must be set by the 30th June 2021. In general, every carbon budget must be set with a view to meeting the 2050 target and complying with the UK's EU and international commitments (The Climate Change Act 2008, 8.2). Carbon budgets are set by the Secretary of State through a statutory order and are subject to approval by parliament (The Climate Change Act 2008, 8.1 and 8.3). Before setting a carbon budget, the government must take into account the advice of the CCC (The Climate Change Act 2008, 9.1.a). If the government decides to set the carbon budget at a different level from that recommended by the CCC,

it must publish a statement explaining the reasons for that decision (The Climate Change Act 2008, 9.4).

Furthermore, additional aspects to be taken into account by the government and the CCC in relation to carbon budgets are described in section 10.2 of the act (The Climate Change Act 2008, 10.1). The list in section 10.2 is not exhaustive so the government and the CCC could also consider other relevant matters (The Climate Change Act 2008, 10.7). However, the wide range of matters which are relevant in the context of carbon budgets is in clear contrast to the narrow scope of matters that apply for amending the 2050 target (Hill, 2009). The matters to be considered in relation to carbon budgets are:

- "*scientific knowledge about climate change;*
- *technology relevant to climate change;*
- *economic circumstances, and in particular the likely impact of the decision on the economy and the competitiveness of particular sectors of the economy;*
- *fiscal circumstances, and in particular the likely impact of the decision on taxation, public spending and public borrowing;*
- *social circumstances, and in particular the likely impact of the decision on fuel poverty;*
- *energy policy, and in particular the likely impact of the decision on energy supplies and the carbon and energy intensity of the economy;*
- *differences in circumstances between England, Wales, Scotland and Northern Ireland;*
- *circumstances at European and international level;*
- *the estimated amount of reportable emissions from international aviation and international shipping for the budgetary period or periods in question*" (The Climate Change Act 2008, 10.2).

Up to now, five carbon budgets have been set, encompassing the period from 2008 to 2032 (The Carbon Budgets Order 2009; The Carbon Budgets Order 2011; The Carbon Budgets Order 2016). The first two carbon budgets have been met and the third budget is also on track to be achieved. However, the UK is currently not on track to meet its fourth and fifth carbon budget, with a gap of +5.6% and +9.6% respectively between expected results from existing and proposed policies and the carbon budgets (for details see Table 5) (DBEIS, 2019c, p 21).

If the government argues that there have been substantial changes to the basis on which the budget was originally set, the level of a carbon budget can be amended (The Climate Change Act 2008, 21.2). The procedure for such an amendment is similar to that of setting a carbon budget. Amendments are thus implemented by order of the Secretary of State which is subject to approval by parliament (The Climate Change Act 2008, 21.5). Before amending a carbon budget the government

Table 5: Overview on existing carbon budgets including actual and projected performance (Adapted from DBEIS, 2019c, p 21; DBEIS, 2019b, p 2)

Carbon budgets (years covered)	1 (2008-12)	2 (2013-17)	3 (2018-22)	4 (2023-27)	5 (2028-32)
Cumulative emissions	3,018 $MtCO_2e$	2,782 $MtCO_2e$	2,544 $MtCO_2e$	1,950 $MtCO_2e$	1,725 $MtCO_2e$
Annual reduction relative to 1990	-25%	-31%	-37%	-51%	-57%
Results relative to carbon budget	-1.2% (actual)	-9.0% (actual)	-3.4% (projected)	+5.6% (projected)	+9.6% (projected)

must obtain and take into account the advice of the CCC (The Climate Change Act 2008, 22.1.a). If the order makes provisions that deviate from the recommendation of the CCC, the government must publish a statement explaining the reasons for that decision (The Climate Change Act 2008, 21.7). If a budget is to be amended after the start of that budgetary period, the substantial changes justifying the amendment must have occurred since the budget period began (The Climate Change Act 2008, 21.3). Budgetary periods can be altered as well, but only to keep them in line with similar periods under any European or international agreement that the UK is party to (The Climate Change Act 2008, 23.2).

For each budgetary period, the net amount of international carbon credits that may be credited to the net UK carbon account for that period are to be limited by the government (The Climate Change Act 2008, 11). It is important to note that this only concerns international carbon credits outside the EU ETS. In practice, the government is required to specify how many international carbon credits will be allowed to be used in the UK, which thereby indicates the extent of domestic action required to meet the carbon budgets (Hill, 2009). Similarly to carbon budgets, limits on international carbon credits are set by order of the Secretary of State, after obtaining and considering the CCC's advice, and are subject to parliamentary approval (The Climate Change Act 2008, 11.4, 11.6 and 11.7.a). Limits must be set at least 18 months before the start of the relevant budgetary period (The Climate Change Act 2008, 11.3.b). In the first budgetary period, a zero limit for international carbon credits was determined, while for the second and third budgetary period a limit of 55 $MtCO_2e$ was set, equaling about 2% of the total budget for both the second and third period (The Climate Change Act 2008 (2020 Target, Credit Limit and Definitions) Order 2009; The Climate Change Act 2008 (Credit Limit) Order 2011; The Climate Change Act 2008 (Credit Limit) Order 2016). Setting a limit on carbon credits for the fourth carbon budget (2023-2027) will be due in 2021.

The act further allows for 'banking' and 'borrowing' between budgetary periods. On the one hand, borrowing allows up to 1% of a carbon budget of a future budgetary period to be carried back to the preceding budgetary period, thus reducing the future budget while increasing the earlier budget, which means that emission reductions under the earlier budget become less challenging to achieve (The Climate Change Act 2008, 17.1 and 17.2). On the other hand, banking allows for the whole or part of any amount by which a carbon budget exceeds the net UK carbon account to be carried forward, thus increasing the future carbon budget (The Climate Change Act 2008, 17.3). However, before the government can decide to bank or borrow, the advice of the CCC must first be obtained and considered (The Climate Change Act 2008, 17.4.b). Decisions to either bank or borrow emissions between different carbon budgets must be made no later than the 31st May in the second year after the previous budgetary period ends (for instance, no later than 31st May 2014 for the 2008-2012 budget) (The Climate Change Act 2008, 17.5), which is the same date as for the final statement for the previous budgetary period under section 18 of the act (The Climate Change Act 2008, 18). In this context, the government argues that over-performance under the first three carbon budgets can compensate for the expected deficit during the fourth and fifth budgetary period (see Table 5). However, the CCC has taken a clear stand that it is unlikely to recommend such an approach, as it would not represent a cost-effective path to meet the 2050 target and could put future emission reduction progress at risk (Fankhauser et al., 2018).

5.2.3 Government reporting and planning

A reporting framework is established by the UK CCA, requiring the government to report directly to parliament regarding several matters and thereby ensuring that implementation of the act is subject to continuous parliamentary scrutiny (Weeks, 2017). Under the act, the government must report on an annual basis on UK GHG emissions, UK removals and net UK emissions regarding each GHG (The Climate Change Act 2008, 16.2). These statements must be laid before parliament by the 31st March in the second year after the year to which the period relates (for instance the 2018 report must be laid by the 31st of March 2020) (The Climate Change Act 2008, 16.10). To date, this deadline has been reached by all annual statements, with the 2017 statement being published on the 28th March 2019 (DBEIS, 2019a). In addition, the act requires the government to respond to the annual progress reports of the CCC (see Section 5.2.4) (The Climate Change Act 2008, 37). The response must be laid before parliament no later than the 15th October in the year in which the CCC's report is made (The Climate Change Act 2008, 37.4). Again, these deadlines have so far been met, with the last response published on the 15th October 2018 relating to the CCC's report of the same year (HM Government, 2018).

Furthermore, the five-yearly cycles of carbon budgets trigger several reporting and planning requirements. After setting a carbon budget, the government must report indicative annual ranges for the net UK carbon account for each year of that budgetary period to parliament. No explicit deadline for this report is set in the act, although it is mentioned that it should be published as soon as is reasonably practicable after setting the carbon budget for a budgetary period (The Climate Change Act 2008, 12.1). In addition, the government must both prepare and report to parliament on proposals and policies that will enable the carbon budgets for current and future budgetary periods to be met (The Climate Change Act 2008, 13 and 14). The proposals and policies must be prepared with a view to meeting the 2050 target and, taken as a whole, must contribute to sustainable development (The Climate Change Act 2008, 13.2 and 13.3). The report must include details on how the proposals and policies will affect different sectors of the economy, the timescales over which the policies are expected to take effect, and how carbon units will be used in the budgetary period (The Climate Change Act 2008, 14.2-14.4). Again, no explicit deadline for these reports is set, although the report must be published as soon as is reasonably practicable after setting the carbon budget for a budgetary period (The Climate Change Act 2008, 14.1). The report on proposals and policies for meeting the first three carbon budgets (called Low Carbon Transition Plan) was issued within two months after setting the budgets, and was published in July 2009 (HM Government, 2009). Subsequently, the report on the fourth carbon budget (called Carbon Plan) was delivered within five months and was published in December 2011 (HM Government, 2011). However, the report concerning the fifth carbon budget (called Clean Growth Strategy) was only issued after 15 months following adoption and was published in October 2017 (HM Government, 2017a). Assumingly, this delay was affected by political events such as Brexit and the June 2017 snap election (Weeks, 2017). The delay was subject to mounting criticism from civil society (Church, 2016) as well as from the CCC (CCC, 2017a). When the document was finally published, it was criticized as still not meeting the requirements of the act, as the proposed measures were not adequate to achieve the set targets (Client Earth, 2017).

For each budgetary period, the government is also required to lay a final statement before parliament with respect to UK emissions, UK removals and resulting net UK emissions for each GHG, the number of carbon units credited to or debited from the net UK carbon account, and the final net UK carbon account for the relevant period as well as any adjustments (borrowing and banking) or alterations to the carbon budget (The Climate Change Act 2008, 18.2-18.6). This final statement must be laid before parliament no later than the 31st May in the second year following the end of the budgetary period to which it relates (The Climate Change Act 2008, 18.9). In case the carbon budget has not been achieved, the final statement must explain why it has not been met (The Climate Change Act 2008, 18.8), and the government must as soon as is reasonably practicable lay a report before parliament setting

out proposals and policies to compensate the excess emissions in future periods (The Climate Change Act 2008, 19). The final statement for the first and second budgetary period (2008-2012; 2013-2017) were published in May 2014 and May 2019 and show that required emission reductions were outperformed by 1.2% for the first budgetary period and 9.0% for the second budgetary period (DBEIS, 2014, 2019b). The final statement for the third budgetary period (2018-2022) is due by the end of May 2024 and currently a performance of -3.4% is projected (see Table 5). Similarly to the final statements for budgetary periods, the government must present a final statement to parliament on final figures regarding the net UK carbon account in 2050 as well (The Climate Change Act 2008, 20.2-20.4), which is due no later than the 31st May 2052 (The Climate Change Act 2008, 20.7). Again, in case the 2050 target is not met, this final statement must explain why the target has not been met (The Climate Change Act 2008, 20.6).

Although most of the act deals with the creation of a framework for climate change mitigation, a framework to drive action on climate change adaptation is introduced as well in part 4 of the act. The main aspects of the adaptation framework include requirements for the government to assess the risks of the impact of climate change for the UK and to develop a program detailing proposals and policies for climate change adaptation (Weeks, 2017). Impact reports are required every five years and must consider the advice from the CCC (The Climate Change Act 2008, 56.3 and 56.5). In accordance with the timeline of the act, the first and second impact reports (called Climate Change Risk Assessment) were laid before parliament in January 2012 and January 2017 (HM Government, 2012, 2017b). These impact reports must be followed by the adaptation programs as soon as is reasonably practicable (The Climate Change Act 2008, 58.3). The first and second adaptation programs (called National Adaptation Program) were delivered in 2013 and 2018 (DEFRA, 2013, 2018). As the the issue of adaptation is a devolved responsibility, the impact reports cover the entire UK, although the adaptation programs only concern England, whereas Scotland, Wales and Northern Ireland each have their own adaptation arrangements (Fankhauser et al., 2018).

5.2.4 Committee on Climate Change (CCC)

The CCC is an independent expert body which advises the government on key matters under the act as well as monitors and reports on the government's progress towards achieving the emission targets and carbon budgets (Hill, 2009). The CCC is classified as a non-departmental public body, which is a body having a role in the processes of national government, but not forming part of any government department (Averchenkova et al., 2018). The CCC is widely praised for its independence and objectiveness, which is seen as crucial to the success of the UK CCA. Initially, the CCC was set-up in shadow form in early 2008, in order to advise the government

on the level of the 2050 target as well as the first three carbon budgets (2008-2012, 2013-2017 and 2018-2022), after which it was formally established in December 2008 following the UK CCA entering into force (Fankhauser et al., 2018). Like the act itself, both mitigation and adaptation are covered by the CCC, the latter through its mandatory Adaptation Sub-Committee (ASC) (The Climate Change Act 2008, schedule 1, 16.1).

The CCC comprises a chair and additional five to eight committee members[9] with knowledge and experience in i.e. business competitiveness, climate change policy, climate and environmental science, differences in circumstances between the devolved administrations, economic analysis and forecasting, emissions trading, energy supply and production, financial investment as well as technology development and diffusion (The Climate Change Act 2008, schedule 1, 1.1 and 1.3). The ASC consists of a chair and at least five other members[10] (The Climate Change Act 2008, schedule 1, 16.2.b). The CCC has a general power to establish other sub-committees as well (The Climate Change Act 2008, schedule 1, 15.1). The chair of the CCC is appointed by the Prime Minister, whereas committee members are appointed by the responsible Secretary of State (DBEIS for CCC members and DEFRA for ASC members), although the respective selection processes are led by the chairs of the CCC and ASC. This selection process has not always been without difficulties though, as in the past choices were rejected and currently a delay in the approval of new members by the Secretary of State affects the renewal of the committee (Averchenkova et al., 2018).

For a public body, the CCC has seen unprecedented stability, having had just two chairs in the ten years of its existence (Fankhauser et al., 2018). The first chair, Lord Adair Turner, has presided over the CCC from 2008 to 2012 and was succeeded by the current chair, Lord Deben, who is a member of the House of Lords, former Conservative member of parliament, and former Secretary of State for the Environment from 1993-1997 (Weeks, 2017). In addition, most of the members who were part of the CCC from when it was established in 2008 were still there to advise on the fifth carbon budget in 2016 (Fankhauser et al., 2018). No fixed terms of office exist, as the members hold and vacate office in accordance with the terms of the member's appointment (The Climate Change Act 2008, schedule 1, 3). Members can be reappointed as well, and can also be removed in limited circumstances such as following persistent absence, bankruptcy, etc. (The Climate Change Act 2008,

[9]The CCC currently has eight members: Lord Deben (chair), Baroness Brown of Cambridge DBE FREng FRS (deputy chair), Professor Nick Chater FBA, Professor Piers Forster, Dr Rebecca Heaton FICFor, Paul Johnson, Professor Corinne Le Quéré FRS and Professor Jim Skea CBE (CCC, 2018e).

[10]The ASC currently has six members: Baroness Brown of Cambridge DBE FREng FRS, Professor Michael Davies, Professor Jim Hall FREng, Professor Dame Georgina Mace DBE FRS, Ece Ozdemiroglu and Rosalyn Schofield LLB (CCC, 2018d).

schedule 1, 3.5 and 3.7). According to its Annual Report and Accounts 2017-18, the CCC chairs and committee members are typically appointed for a fixed period of up to five years (CCC, 2018a).

The CCC relies heavily on a secretariat with a staff of about 30 people, led by the chief executive[11] (Averchenkova et al., 2018), who is appointed by the committee but subject to approval by the national authorities (The Climate Change Act 2008, schedule 1, 11.1). About 20 of the secretariat staff specialize in mitigation, whereas the teams for adaptation and corporate services, including finance and communications, employ five people each. A broad range of skills is represented in the secretariat, including technical (mainly economics and the physical sciences) and modeling expertise (Averchenkova et al., 2018). Some core members of the secretariat have been part of the team for over ten years, making the secretariat highly experienced (Fankhauser et al., 2018). Since 2009/10, the first year of full operation, the average annual budget of the CCC amounted to about 4.2 million Euros. This includes a sizeable consultancy budget, allowing the secretariat to bring in external expertise to cover specialist skill gaps. Supplementary analysis and consultant reports accompany most CCC reports, although the core analysis, quality control and interpretation are performed in-house. Two government departments provide most of the CCC's financial resources, DBEIS for mitigation and DEFRA for adaptation, while the devolved administrations contribute as well. The CCC thus relies financially on the same government it is tasked to scrutinize, which is considered as a clear shortcoming (Averchenkova et al., 2018).

Advising the government on key matters under the act, particularly on carbon budgets, is one of the main responsibilities of the CCC (Hill, 2009). Additionally, the committee can be requested to carry out analyses on particular questions related to the act (The Climate Change Act 2008, 38), which has been the case for e.g. airport emissions and renewables (Fankhauser et al., 2018). The devolved administrations also have access to the expertise of the CCC (The Climate Change Act 2008, 38), which they regularly make use of (Fankhauser et al., 2018). The first duty of the CCC was to advise the government on the level of the 2050 target by December 2008 (The Climate Change Act 2008, 33). In case this long-term target were to change, the CCC would have to be consulted again. This has happened in 2018, when the government asked the CCC to provide its advice on a potential amendment of the 2050 target in order to align it with the requirements of the Paris Agreement (see Section 5.2.1). Furthermore, the government depends on advice from the CCC regarding the carbon budgets (The Climate Change Act 2008, 34), specifically with respect to:

[11] The secretariat is currently led by chief executive Chris Stark, who succeeded Matthew Bell in April 2018 after Bell's resignation in 2017 (CCC, 2018c).

- the level of the budget
- the extent to which the budget should be met by the use of carbon units or by reducing the amount of net UK emissions of targeted GHGs
- the contributions to be made by different sectors of the economy, whether covered by trading schemes or not, and
- the sectors of the economy in which there are particular opportunities for contributions towards meeting the carbon budgets (The Climate Change Act 2008, 34.1.a-34.1.d)

The CCC's advice on carbon budgets must take into account the same matters as the Secretary of State must consider when setting budgets (see Section 5.2.2) (The Climate Change Act 2008, 10.1.b). Furthermore, the CCC must give advice on emissions from international aviation and shipping and the effects of treating such emissions as emissions from UK sources as well (The Climate Change Act 2008, 35.1), which needs to be performed for each budgetary period until regulations are passed to include these emissions into the main carbon budget system (Hill, 2009). The CCC must give reasons for its advise and must give its advice at least six months before the deadline for setting the relevant carbon budget (The Climate Change Act 2008, 34.3 and 34.4). So far the CCC has made recommendations on five carbon budgets covering the period 2008 to 2032 (CCC, 2008, 2010, 2015a), and its advice on the sixth carbon budget (2033-2037) is due at the end of 2020.

Monitoring and reporting on the government's progress towards reaching the emission targets and carbon budgets is another important responsibility of the CCC (Hill, 2009). In particular, the CCC must report annually to parliament setting out the committee's views on:

- the progress towards meeting the carbon budgets that have been set and the 2050 target
- the further progress that is needed to meet the carbon budgets and the 2050 target
- whether the carbon budgets and the 2050 target are likely to be met (The Climate Change Act 2008, 36.1).

At the end of each budgetary period, the CCC must also give its views on the way in which the budget for the period was or was not met, and action taken during the period to reduce net UK emission of targeted GHGs (The Climate Change Act 2008, 36.2). The annual reports on progress are normally due by the 30th June each year, however, the report concerning the end of a five-year carbon budget is due on the 15th July in the second year after the end of the budgetary period, e.g. the report for the 2013-2017 budget was due by the 15th July 2019 (The Climate Change Act 2008, 36.4 and 36.5). To date, these deadlines have been reached by all annual reports on progress, with the 2019 report being published on the 10th July 2019 (CCC, 2019c).

A response by the government to the CCC's report on progress must be provided by laying a report before parliament each year (see Section 5.2.3).

The CCC's duties relating to adaptation are discharged by the ASC (Averchenkova et al., 2018), which advises the government on the preparation of the impact reports (see Section 5.2.3) no later than six months before this report must be laid before parliament (The Climate Change Act 2008, 57.1 and 57.2). The ASC has begun to assume a more direct role in assessing climate change risks. Whereas for the first impact report, which was issued in 2011, the ASC acted as an external advisor, the collection and interpretation of the evidence on climate risks, on which the impact report is based, was performed by the ASC itself starting with the second impact report (Averchenkova et al., 2018). The ASC issued its evidence report for the first and second impact report in 2011 and 2016 respectively, while the third impact report is due for publication in 2021 (CCC, 2016c; HM Government, 2012). Additionally, the ASC must assess the progress made towards implementing the objectives, proposals and policies set out in the adaptation programs laid before parliament (see Section 5.2.3) in context of the CCC's reports on progress (The Climate Change Act 2008, 59.1). In accordance with the provisions under the act, the ASC issued its first assessment of the adaptation program in 2015 and now reports biennially (CCC, 2015b, 2017b, 2019b; The Climate Change Act 2008, 59.2 and 59.3).

The timeline in Figure 16 visualizes the reporting and planning framework established by the UK CCA, including the advisory and monitoring activities of the CCC (highlighted in bold with grey background), over an exemplary five-year budgetary period. For some reporting requirements, the act does not foresee any specific dates but refers to a publication as soon as is reasonably practicable (e.g. the report on proposals and policies for meeting carbon budgets). These reporting requirements are indicated in the timeline in relation to their triggering event (e.g. the government's setting of a carbon budget), as visualized by an arrow between the respective boxes. Moreover, the timeline visualizes the reporting framework for mitigation only, since reporting requirements relating to adaptation follow a different five-year cycle.

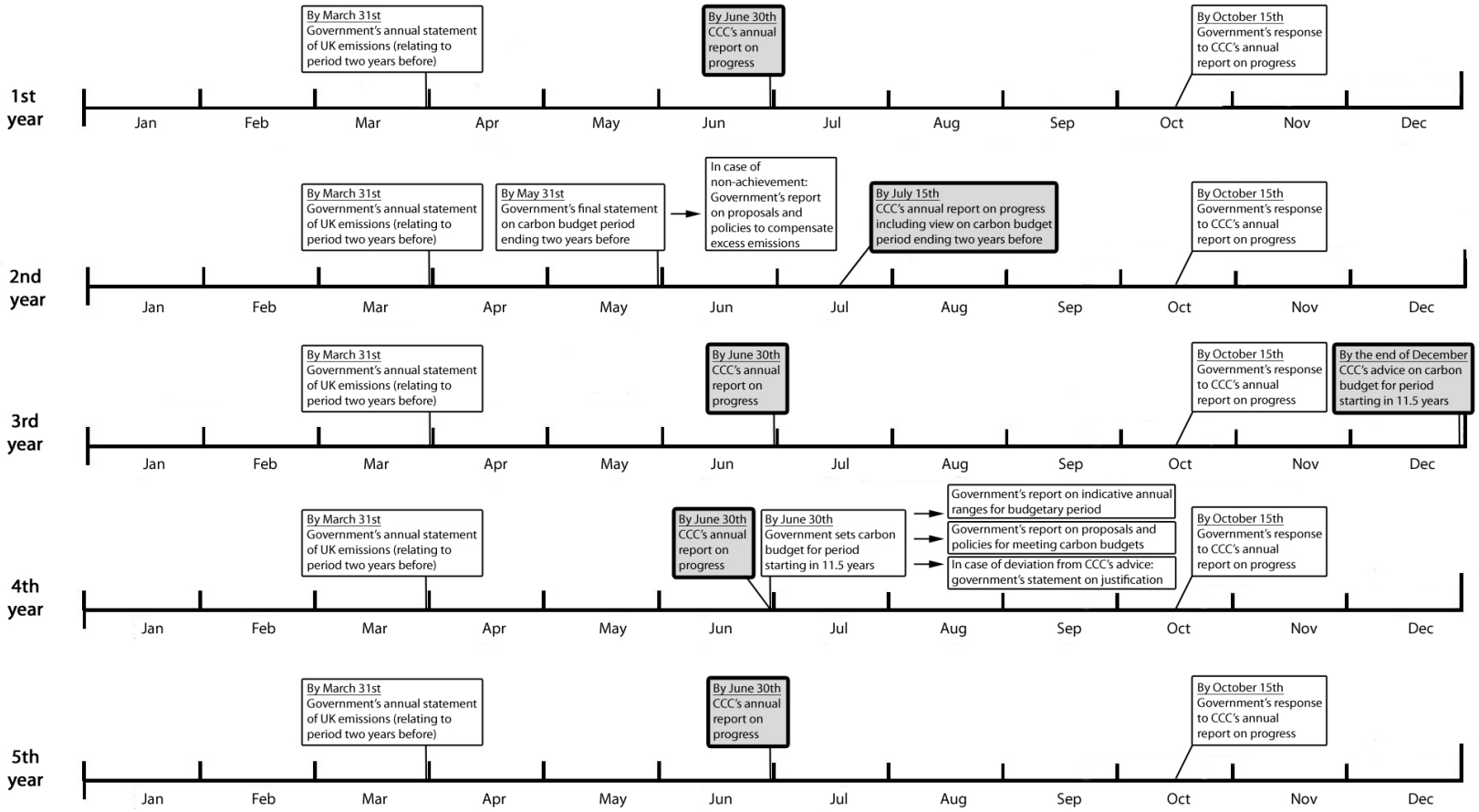

Figure 16: Timeline on reporting and planning requirements established by the UK CCA including advisory and monitoring activities of the CCC during an exemplary five-year budgetary period (Own compilation, data from The Climate Change Act 2008)

Until today, the main recommendations of the CCC have generally been accepted, including its advice on carbon budgets, although not without debate and not always to the letter. The same political consensus that contributed to the UK CCA was still in place for the adoption of the first set of recommendations on the 2050 target and the first three carbon budgets, all made in 2008 (Averchenkova et al., 2018). It is noteworthy that, with a view to the Copenhagen Summit in December 2009, the CCC proposed two sets of budgets for the first three budgetary periods, one to apply following a global deal on emission reductions ('intended' budgets requiring emission reductions of 42% in 2020 compared to 1990), and the other to apply for the period before a global deal is reached ('interim' budgets, requiring a reduction of 34%) (CCC, 2008). As the expected global deal was not reached, the first three carbon budgets were set at the approximate level of the recommended 'interim' budgets (Averchenkova et al., 2018). Interestingly, the second and third carbon budgets were set at a slightly lower level, compared to the recommended 'interim' budgets (with a difference of 37 and 26 $MtCO_2e$ respectively) (CCC, 2008; The Carbon Budgets Order 2009). By the time the fourth carbon budget was set in 2011, the political climate had changed, leading to considerable opposition, including from the Treasury, to the recommendations made by the CCC. Ultimately, the fourth carbon budget was adopted as recommended, although its level was to be reviewed a few years later as a compromise towards the opponents of the budget (Averchenkova et al., 2018). This review was carried out in 2013, with the CCC concluding that its earlier recommendation remained valid (CCC, 2013a,b). Subsequently, the government decided in July 2014 to leave the fourth budget unchanged (Macrory, 2014). The CCC's further recommendation to tighten the second and third carbon budgets to the level of the earlier recommended 'intended' budgets was not considered by the government. In 2016, the level of the fifth carbon budget was set as recommended by the CCC, although the suggestion to include emissions from international shipping into the accounting framework was ignored (Averchenkova et al., 2018). Despite the repeated recommendations of the CCC to meet carbon budgets without the use of international carbon credits outside the EU ETS (CCC, 2008, 2010, 2015a), this advice has only been followed for the first carbon budget (The Climate Change Act 2008 (2020 Target, Credit Limit and Definitions) Order 2009), but not the second and third period, where a limit of 55 $MtCO_2e$ for international carbon credits was set (The Climate Change Act 2008 (Credit Limit) Order 2011; The Climate Change Act 2008 (Credit Limit) Order 2016). Setting a limit on international carbon credits for the fourth budget (2023-2027) will be due in 2021 (see Section 5.2.2).

In May 2019, the CCC published its advice regarding a new long-term target in light of the Paris Agreement as requested by the government (see Section 5.2.1). The CCC concluded that the UK should aim to meet net-zero emissions by 2050, which responds to the latest climate science and fully meets the UK's obligations under the Paris Agreement. According to the CCC, a 100% reduction in GHG emissions

compared to 1990 should be legislated, covering all sectors of the economy including international aviation and shipping. Furthermore, the aim should be to meet the target through UK domestic effort, without relying on international carbon credits. Any remaining emissions should be offset by removals of CO_2 from the atmosphere (e.g. land-based removals or carbon capture and storage), while the use of international carbon credits should only be allowed as a contingency (CCC, 2019a). In June 2019, the government followed the CCC's recommendation and legislated a net-zero target by amending the original 2050 target from 80% to 100% emission reductions (The Climate Change Act 2008 (2050 Target Amendment) Order 2019). However, the government has not yet formally included international aviation and shipping within the target. As another deviation from the CCC's recommendations the government retains the ability to use international carbon credits to offset emissions (Carbon Brief, 2019).

5.2.5 Preliminary conclusions

In the following, the within-case research question is answered for the UK case: **What are the key design elements of the UK CCA in terms of targets set, procedures for planning, reporting and monitoring foreseen, their degree of implementation, as well as their legal bindingness and enforceability?**

The key design elements of the UK CCA are legally-binding emission targets with corresponding five-yearly carbon budgets, statutory government reporting and planning activities as well as the establishment of the CCC to advise the government and monitor progress. The emission targets under the UK CCA consist of a long-term target aiming for net-zero emissions by 2050 as well as an interim target aiming for 34% reduction by 2020 compared to 1990. The original 2050 target aiming for 80% emission reductions compared to 1990 has been revised in June 2019 in order to align the act with the Paris Agreement. In addition, the UK CCA establishes a system of five-yearly carbon budgets set 11.5 years in advance. Prior to the setting or amendment of emission targets as well as carbon budgets the CCC's advice needs to be taken into account and in case of deviation from that advice the government must publish a statement setting out the reasons for that decision. The CCC's advice has generally been followed in this regard and emission targets and carbon budgets are thus backed by expert advice. Up to now, five carbon budgets have been set, encompassing the period from 2008 to 2032. Moreover, the government has a duty under the act to consider the need for UK domestic action and is required to set limits for the use of international carbon credits for each budgetary period, after taking into account the CCC's advice. Such limits have been set for the first three budgetary periods, however, not always in accordance with the CCC's advice.

Furthermore, the setting of each carbon budget triggers specific planning requirements for the government e.g. the presentation of proposals and policies enabling

carbon budgets to be met. No explicit deadline for these reports is set, although they must be published as soon as is reasonably practicable after carbon budgets have been set. The policy plan for the first three carbon budgets (called Low Carbon Transition Plan) as well as the policy plan for the fourth carbon budget (called Carbon Plan) were published within less than half a year. However, the publication of the policy plan for the fifth carbon budget (called Clean Growth Strategy) was awaited for more than one year, which has been criticized by civil society groups as an unnecessary delay. When the Clean Growth Strategy was finally published, it was further criticized for not proposing sufficient measures to enable carbon budgets to be met. In this context, it is important to note that the UK is currently off track for meeting the fourth and fifth carbon budget. In case carbon budgets are not met, the act requires governments to set out additional proposals and policies to compensate the excess emissions in future periods. This gap filler mechanism has not yet come into effect since both the first and the second carbon budget have been met and the third budget is also on track to be achieved.

As for government reporting, the act requires governments to present annual reports on UK emissions, responses to the CCC's annual reports on progress as well as final statements for each budgetary period. The government's annual report on UK emissions as well as the final statements for each budgetary period primarily provide information on emission accounting, whereas the response to the CCC's annual progress report gives account on progress towards achieving the emission targets and carbon budgets. The main reporting duty under the UK CCA is thus structured along the recommendations given in the CCC's annual report on progress. All of these procedural steps have so far been met, with the government responding to the CCC's progress reports on each occasion, delivering the reports on UK emissions every year and issuing final statements for the first two budgetary periods, which have already ended.

The CCC's main monitoring activities are presenting annual assessment reports on progress towards achieving emission targets and carbon budgets as well as giving its views at each ending budgetary period on the way in which the budget for the period was or was not met. Moreover, the CCC is required to advise the government on key matters under the act, e.g. regarding carbon budgets, emission targets and limits for international carbon credits. Additionally, the CCC can be requested to carry out analyses on other particular questions related to the act. Again, all of these procedural steps have been met, with the CCC giving its advice on each occasion, delivering its reports on progress every year and presenting its views on the two budgetary periods that have already ended. Overall, the CCC is widely praised for its independence and objectiveness, which is seen as crucial to the success of the UK CCA. However, the CCC's advice has not always been followed e.g. with regard to limits for the use of international carbon credits or the inclusion of emissions from

international aviation and shipping. In addition, due to emerging opposition within government towards the CCC's advice regarding the level of the fourth carbon budget in 2011, the budget was only adopted at the advised level based on the conditionality of a review after three years. Following this review, the CCC concluded in 2014 that its initial recommendations remained valid and the government decided to leave the fourth carbon budget unchanged. This is an example of the fact that implementation of the UK CCA remains subject to political changes despite its legally binding nature.

In general, processes for government reporting and planning as well as processes for monitoring and evaluation under the UK CCA are supervised by parliament, which means that both the government and the CCC directly report to parliament. Additionally, several matters under the UK CCA are subject to parliamentary approval e.g. the setting or amendment of emission targets and carbon budgets as well as the setting of limits for international carbon credits. As for enforceability, the provisions under the UK CCA are legally binding and could thus be subject to judicial review. However, uncertainties exist in particular regarding the enforceability of the act's substantive duties (such as meeting emission targets or carbon budgets), due to the difficulty of finding effective and appropriate remedies in case of non-compliance.

Chapter 6

Comparison

This chapter compares both case studies using the analytical framework outlined in Chapter 3, thereby providing analytical evidence for answering the cross-case research question: What is the potential of the Swedish Climate Policy Framework compared to the UK CCA for facilitating climate policy across sectors? The analytical framework for this comparative analysis combines the concept of CPI with factors influencing the effectiveness of CCAs, and is structured along three key design elements of CCAs: emission targets, policy planning, as well as reporting and monitoring (see Chapter 3).

6.1 Emission targets

One of the main differences between the Swedish Climate Policy Framework and the UK CCA can be identified regarding the legal bindingness of their emission targets. In Sweden, it was chosen to not numerically include emissions targets in the legislative text of the SCA, but instead adopt the targets with a non-binding parliamentary directive. This leaves Swedish governments with great flexibility regarding possible amendments of emission targets without the approval of parliament. In contrast, the UK CCA prominently features legally binding emission targets in its first section and further regulates that amendments are subject to parliamentary approval. Overall, statutory emission targets under the UK CCA seem to be better equipped to enhance climate policy efforts across sectors, although they nonetheless remain subject to political changes. In addition, the UK CCA requires governments to take into account the CCC's advice prior to the setting or amendment of emission targets. The CCC's advice has generally been followed in this regard and the UK emission targets are thus based on the advice of the independent advisory committee, which makes it politically less viable for governments to turn around already made commitments. The Swedish emission targets are a result of the CPCEO's consultations, a committee consisting of members of parliament, advisers from civil society groups as well as government ministries, and are thus based on a political agreement. The

CPC, as an independent advisory body established under the Swedish Climate Policy Framework, is not tasked with providing advice with regard to the setting or amendment of emission targets.

In terms of ambition, the Swedish long-term target aiming for net-zero emissions by 2045 and subsequently achieving negative emissions is clearly more far-reaching than the UK long-term target aiming for net-zero emissions by 2050. Nevertheless, both long-term targets are in line with the requirements of the Paris Agreement as they align with a global objective of limiting global mean temperature rise to well below 2°C and striving for 1.5°C as well as reaching net-zero emissions in the second half of the century. In this context it must be noted that the UK CCA (2008) precedes the Paris Agreement (2015) and thus was developed under different circumstances (relating to a global objective of limiting global mean temperature rise to below 2°C), however, the original long-term target (80% emission reductions by 2050 compared to 1990) has been revised in June 2019 in order to match the requirements of the Paris Agreement. Overall, it can be argued that aligning national emission targets with international commitments strengthens the relevance of climate action in sector policy-making. In addition, interim targets under the Swedish Climate Policy Framework are currently set in 10 year intervals i.e. 2030 and 2040, whereas the UK CCA sets one interim target for 2020 and further adds a system of five-yearly carbon budgets. In this context, it can be concluded that the combination of long-term and medium-term target setting with the periodic setting of carbon budgets under the UK CCA arguably has greater potential to effectively guide decarbonization by setting out a clear trajectory for emission reductions. In contrast, the Swedish Climate Policy Framework does not include a short-term perspective, which reduces the potential for guiding emission reduction efforts from one year to the next. A clear particularity of the Swedish Climate Policy Framework is the introduction of an additional interim target for the transport sector for 2030. Such an interim target potentially serves as a call for action for the Swedish transport sector and provides a point of reference for stepping up climate ambition. In addition, it also recognizes the difficulty of reducing emissions in this sector to date. Nevertheless, a comprehensive breakdown of the overall emission reduction commitment to the sectoral level is missing in both countries. Particularly in the UK, where historically most emission reductions go back to a shift of the UK's energy mix from coal to gas, the potential of sectoral targets is worth exploring. Ultimately, it is important to note that both Sweden and the UK are currently not on track for meeting their emission targets and thus the effectiveness of both the Swedish Climate Policy Framework and the UK CCA can be questioned in this regard.

Regarding the scope of the emission targets, both the Swedish Climate Policy Framework and the UK CCA do not cover emissions from international aviation and shipping, which can be interpreted as a lack of ambition to reduce emissions in these

sectors. In Sweden, emissions under the EU ETS are further only covered by the long-term target but not the interim targets, which means no reduction pathway is set out for these respective sectors at all. This is particularly problematic as the EU ETS is widely criticized for failing to deliver sufficient emission reductions. Both the UK CCA and the Swedish Climate Policy Framework provide clear definitions on the relative importance of domestic emission reductions to international offsets but pursue different approaches with regard to procedural aspects. In Sweden, both the long-term and interim targets indicate shares, which may be reached by supplementary measures such as increased uptake of CO_2 by carbon sinks or investing in climate projects abroad. These limits for supplementary measures are not legally binding and can be altered by the government without approval of parliament, as they are based on the same non-binding parliamentary directive as the emission targets. The UK CCA more generally emphasizes a duty to consider the need for domestic action and requires the government to indicate the extent of domestic action by setting limits for international carbon credits for each budgetary period. These limits are legally binding as they are set by order of the Secretary of State, after obtaining and considering the CCC's advice, and are subject to parliamentary approval. It can be concluded that the general focus on domestic action under the UK CCA combined with the periodic setting of statutory limits for international carbon credits sends a clearer signal to sector policy-making regarding the urgency and comprehensiveness of climate action.

6.2 Policy planning

Turning to policy planning, both the UK CCA and the SCA establish procedural obligations requiring governments to present policy plans at regular intervals. However, the periodic setting of five-yearly carbon budgets combined with specific planning requirements under the UK CCA clearly sets out a more complex mechanism for policy planning. Such statutory carbon budgets are set 11.5 years in advance by order of the Secretary of State, after obtaining and considering the CCC's advice, and are subject to approval by parliament. Furthermore, the setting of carbon budgets triggers specific planning requirements, for example governments must report to parliament on proposals and policies for meeting carbon budgets. In Sweden, the SCA similarly obliges governments to present climate policy action plans to parliament, in order to set out how the government intends to achieve the emission targets. However, the policy planning mechanism under the SCA does not foresee a similar system to the one of carbon budgets, but connects cycles of policy planning to Swedish government terms. Climate policy action plans must accordingly be drawn up every fourth year and be presented to parliament in the year after ordinary elections have been held. Overall, the clear linkage between emission reduction commitments and cycles of policy planning established through the system of carbon budgets under the UK CCA

generally seems to be better equipped for guiding climate policy planning towards decarbonization. In contrast, cycles of policy planning under the SCA appear rather disconnected from the current 10 year intervals of interim targets and even more so from the long-term target.

Requirements under the UK CCA and the SCA regarding the content of policy plans are overall quite similar. According to the SCA, climate policy action plans must include details on planned emission reduction measures within different policy areas, including an approximate timeframe for implementation, as well as projected outcomes with regard to national and international emission targets. Under the UK CCA, policy plans must include details on policies that will enable the carbon budgets for current and future budgetary periods to be met, how such policies will affect different sectors of the economy and the timescales over which the policies are expected to take effect. Nevertheless, it must be emphasized that the ambition of policy plans in both countries still depends on the priorities of governments and its ministries, and thus remains vulnerable to political developments. For example, the policy plan published after the fifth carbon budget under the UK CCA was criticized for not proposing sufficient measures to enable carbon budgets to be met. As for Sweden, the first policy plan under the SCA is yet to be published. In this context, an ex-ante mechanism for bridging ambition gaps of policy plans in the first place might be worth exploring in both countries, for example a procedural obligation for the revision of insufficient policy plans.

In general, such policy planning processes require input from different sectors of government and therefore also support coordination processes to a certain extent. However, it is important to note that both the SCA and the UK CCA do not regulate government's internal collaboration, but rather focus on communication and distribution of responsibilities between government and parliament. It follows, that the extent to which climate policy efforts are integrated in relevant policy areas clearly depends on the willingness of government sectors to collaborate with each other and link their sectoral planning to the process of the UK CCA or the SCA respectively. Ultimately, it is left to different sectors of government to develop procedures for policy integration e.g. ex-ante assessments on climate impacts for sectoral policy decisions. Only the Swedish transport sector has a special position in this regard, as it is covered by an interim target setting out a sectoral commitment for emission reductions by 2030, which is however not legally binding.

From a procedural perspective, both the UK CCA and the SCA foster continuity in climate policy planning, which is thus less depending on political will of governments and respective sectors. The UK CCA states that policy plans must be published as soon as is reasonably possible after carbon budgets have been set, however, it does not state a specific deadline for the publication of such plans. In this context, the report

on proposals and policies for the fifth carbon budget was only issued after 15 months following the adoption of the budget, which has been criticized by civil society groups as an unnecessary delay. As for the SCA, the publication of policy plans is scheduled for the second year of the governmental term, which leaves relatively little time for actual policy implementation and further means that a new government would in its first year theoretically work under the plan of the previous government. However, it is highly questionable if a government would stick to the plan of its predecessor, in particular as such plans usually have no statutory basis. It can be concluded that these procedural obstacles unnecessarily hamper the continuity of policy planning and subsequently also implementation.

Ultimately, both the SCA and the UK CCA do not foresee any sanctions in case of non-compliance. This also applies to the sectoral target for transport under the SCA, as non-fulfillment of the target does not lead to any kind of sanctions for the responsible ministry. As for the UK CCA, a gap filler mechanism is established, which foresees that governments must set out additional proposals and policies to compensate excess emissions in case carbon budgets have not been met. This mechanism has not yet come into effect, since both the first and the second carbon budget have been met. The SCA also set outs a procedure to solve implementation gaps, although this is somewhat hidden in the requirements for the government's annual climate report. As part of this report, the government is required to identify whether further emission reduction measures are needed and when and how such measures should be adopted. As for the first and so far only annual climate report, the government has not complied with these requirements, as it only postulates that further measures are needed, but fails to provide further details on the nature of such measures as well as when and how respective decisions will be taken. This can partially be ascribed to the fact that the budget bill in 2018 was submitted by an interim government with a limited mandate. It thus remains to be seen whether the upcoming second annual climate report is able to overcome these shortcomings. As for the gap filler mechanism under the UK CCA, it can generally be questioned whether its ex-post approach for bridging implementation gaps is adequate, taking into account the urgency of the climate problem as well as the fact that efforts for emission reductions are thus shifted towards later periods. The gap filler mechanism under the SCA seems at least on paper more promising in this regard, as it annually calls on governments to step up climate action in case emission targets are not on track to be met.

6.3 Reporting and monitoring

Both the UK CCA and the Swedish Climate Policy Framework establish statutory government reporting as well as monitoring by independent advisory bodies at regular intervals, however, the UK CCA clearly establishes a more complex system of

bureaucracy in this regard. In general, it can be argued that carrying out these procedural obligations helps to keep climate change on the political agenda and thereby demand action from governments as well as respective sectors. As for government reporting, both the UK CCA and the SCA require governments to report on climate policy on an annual basis, however, they do so with different procedural approaches. Under the UK CCA, the CCC initially presents its annual report on progress followed by the government's response to the CCC's report. Government reporting under the UK CCA is thus clearly structured as a response to the recommendations given by the CCC, which means there is less scope for leaving blind spots or not addressing challenges in certain sectors. In contrast, the SCA foresees that governments first bring forward a climate report as part of the annual budget bill and after that the CPC presents its annual assessment report without any further government response. In this regard it must be noted that the first and so far the only annual climate report under the SCA was criticized for only partially meeting its requirements, i.e. lacking assessment of policy measures indirectly affecting emission reductions as well as lacking information regarding the impact of reported policy measures. Overall, government reporting under the UK CCA seems better equipped to comprehensively hold governments and respective sectors accountable.

Both the UK CCA and the Swedish Climate Policy Framework foresee the creation of independent advisory bodies. However, a significant difference is that provisions regarding the CCC are directly included in the UK CCA, whereas in Sweden, it was chosen to legally implement the CPC with an ordinance adopted by the government, but not mention the council in the legislative text of the SCA. This allows for less political control by the parliament and means that a future government can potentially abolish the Swedish CPC in case it disagrees with its mandate. Another difference between the Swedish CPC and the UK CCC can be identified regarding the extent of their assigned budgets as well as the size of their secretariats. The UK CCC can rely on a secretariat of about 30 people and its average annual budget amounts to about 4.2 million Euros. In contrast, an annual budget of about 1 million Euros is foreseen for the operation of the Swedish CPC and there are currently only three employees working for its secretariat. This shows that the Swedish CPC has limited capacities and resources to conduct its own studies and therefore builds its work for a large part on analyses from other government agencies and research bodies. In this context, the CPC's assessments shall be regarded as a second opinion and complementary to existing analyses. Overall, monitoring activities of both the UK CCC and the Swedish CPC generally support the facilitation of climate policy across sectors, e.g. by identifying shortcomings as well as opportunities of respective sectors for emission reductions. However, the Swedish CPC emphasizes that it has to focus its annual assessments on the most critical issues, e.g. on emissions from domestic transport, due to the above described limited capacities and resources. It can be argued that this approach does not adequately respond to the urgency and comprehensiveness

of the climate problem. In comparison, the UK CCC's annual assessments clearly provide a more comprehensive analysis of policies across different sectors and thus have greater potential to guide sector policy-making towards decarbonization. Moreover, the UK CCC is also tasked with advising the government on key matters under the act, e.g. with regard to carbon budgets. The fact that the UK CCC's advice must be considered by the government indicates that the act aims for scientifically informed government decisions. Additionally, the government is required to publish a statement if its decisions deviate from the UK CCC's advice (e.g. regarding the setting of emission targets and carbon budgets). In this regard, the UK CCA seems once more better equipped to hold governments and respective sectors accountable. As for Sweden, the CPC is further tasked to present an ex-ante assessment of the government's policy plan every four years, which allows for identifying shortcomings of policy plans early on. Under the UK CCA, there are no similar provisions requiring the CCC to evaluate the government's report on proposals and policies for meeting carbon budgets. Nevertheless, the CCC independently presented an evaluation report regarding the government's report on proposals and policies concerning the fifth carbon budget (CCC, 2018b). In general, the added value of such ex-ante assessments remains debatable if no further procedural steps are foreseen. In this regard, a procedural link between ex-ante assessments of policy plans and a potential revision mechanism in case of insufficient policy plans is worth exploring. As already mentioned, such a mechanism might allow for bridging ambition gaps and thereby strengthen compliance.

Turning to parliamentary oversight, both the UK CCA and the SCA provide parliament with a statutory mandate for supervising processes for government reporting. In Sweden, government reporting on climate policy is, according to the SCA, part of the annual budget bill, which is subject to parliamentary treatment. Under the UK CCA, government reporting activities are also directed at parliament, e.g. the responses to the CCC's progress report. With regard to monitoring and evaluation processes, parliamentary oversight is only foreseen under the UK CCA, as the CCC is subordinate to parliament and thus directly reports to parliament. In Sweden, the CPC is subordinate to government and thus directly reports to government regarding its assessments, which further means that the CPC needs to give account of its work to the same government it is tasked to scrutinize. This reduces the CPC's independence and thereby credibility of its assessments, which subsequently also weakens its support function for facilitating climate policy across sectors.

Chapter 7

Conclusions

The aim of this master thesis was to systemically compare the UK CCA and the Swedish Climate Policy Framework, in order to develop an understanding of how both CCAs potentially serve as tools to overcome the common challenge of facilitating climate policy across sectors. The chosen case study research design was based on Yin's (2008) methodological work and thus both cases were initially analyzed separately and then systematically compared in a second step. This chapter presents conclusions based on what has been described and analyzed in the previous chapters.

First, the key design elements of the Swedish Climate Policy Framework and the UK CCA were presented in Chapter 4 and Chapter 5 respectively, thereby providing descriptive evidence for answering the within-case research question, i.e. **"What are the key design elements of the Swedish Climate Policy Framework and the UK CCA?"**. In order to guide case analysis the following sub-questions were further added:

- **What objectives do they set regarding climate policy?**
- **What procedures do they foresee for planning, reporting and monitoring of climate policy and to what degree have they been implemented?**
- **How legally binding are they? Are there any sanctions foreseen in case of non-compliance?**

These within-case research questions were answered separately for Sweden and the UK at the end of Chapter 4 and Chapter 5 respectively. As a next step, both case studies were systematically compared in Chapter 6, thereby providing analytical evidence for answering the cross-case research question, i.e. **"What is the potential of the Swedish Climate Policy Framework compared to the UK CCA for facilitating climate policy across sectors?"**. The analytical framework used for this comparison was outlined in Chapter 3 and combines the concept of CPI with factors influencing the effectiveness of CCAs. In the following, the cross-case research question is answered based on the comparative analysis in Chapter 6.

Overall, the UK CCA seems better equipped to facilitate climate policy across sectors with regard to all three dimensions of CPI, i.e. normative dimension, governance-oriented dimension and output-oriented dimension. As for the normative dimension of CPI, legally binding emission targets under the UK CCA seem to be better equipped to enhance climate policy efforts across sectors, although they nonetheless remain subject to political changes. In addition, the combination of legally binding long-term and medium-term emission targets with the periodic setting of statutory carbon budgets under the UK CCA arguably has greater potential to effectively guide decarbonization by setting out a clear trajectory for emission reductions. Moreover, the fact that emissions from all domestic sources are covered by the UK CCA signals a clear commitment for emission reductions across all sectors. The emission targets as well as carbon budgets have so far been set in accordance with the advice of the CCC, an independent advisory committee established under the UK CCA, which further fosters long-term conditions for emission reductions and makes it politically less viable for governments to lower or discard already made commitments. In contrast, emission targets under the Swedish Climate Policy Framework are not legally binding and leave governments with great flexibility for possible amendments, which can thus not be regarded as a stable long-term commitment. Furthermore, the Swedish Climate Policy Framework only contains a long-term target as well as medium-term targets in 10 year intervals, but no short-term perspective is included, which reduces the potential for guiding emission reduction efforts from one year to the next. In addition, emissions under the EU ETS are only covered by the long-term target but not the medium-term targets, which means no reduction pathway is set out for these respective sectors at all. A clear particularity of the Swedish Climate Policy Framework is the introduction of a sectoral target for domestic transport, which potentially serves as a call for action for the transport sector and provides a point of reference for stepping up climate ambition. Nevertheless, a comprehensive breakdown of the overall emission reduction commitment to the sectoral level is missing in both countries. Overall, the Swedish long-term target is more ambitious than the UK long-term target, although both are in line with the requirements of the Paris Agreement. In this context, it can be argued that aligning national emission targets with international commitments strengthens the relevance of climate action in sector policy-making. Moreover, both the Swedish Climate Policy Framework and the UK CCA provide clear definitions on the relative importance of domestic emission reductions to international offsets, however, the general duty under the UK CCA to consider the need for domestic action sends a much clearer signal to sector policy-making regarding the urgency and comprehensiveness of climate action. Regarding the scope of the emission targets, both the Swedish Climate Policy Framework and the UK CCA do not cover emissions from international aviation and shipping, which can be interpreted as a lack of ambition to reduce emissions in these sectors.

Turning to the governance-oriented dimension of CPI, both the UK CCA and the SCA establish procedural obligations requiring governments to present policy plans at regular intervals. However, the clear linkage between emission reduction commitments and cycles of policy planning established through the system of carbon budgets under the UK CCA generally seems to be better equipped for guiding climate policy planning towards decarbonization. In contrast, cycles of policy planning under the SCA, which are connected to Swedish government terms of four years, appear rather disconnected from the current 10 year intervals of medium-term targets and even more so from the long-term target. Requirements under the UK CCA and the SCA regarding the content of policy plans are overall quite similar. Nevertheless, it is important to emphasize that the actual ambition of policy plans under both the UK CCA and the SCA remains dependent on priorities of governments and thus vulnerable to political developments. In addition, the extent to which climate policy efforts are effectively integrated in relevant policy areas depends on the willingness of government sectors to collaborate with each other and link their sectoral planning to the process of the UK CCA or the SCA respectively. From a procedural perspective, both the UK CCA and the SCA foster continuity in climate policy planning, which thus depends less on political will of governments and respective sectors. However, procedural obstacles remain in both cases, i.e. the UK CCA does not provide a specific deadline for policy plans and the SCA schedules the publication of policy plans only for the second year of the respective governmental term, which leaves relatively little time for actual policy implementation. Ultimately, both the UK CCA and the SCA do not foresee any sanctions in case of non-compliance, but establish gap filler mechanisms in order to bridge implementation gaps. As for the UK CCA, governments must set out additional proposals and policies to compensate excess emissions in case carbon budgets have not been met. Under the SCA, governments are required to annually identify whether further emission reduction measures are needed as well as when and how respective decisions will be taken. Both gap filler mechanisms have so far not fully come into effect, however, the gap filler mechanism under the SCA seems at least on paper more promising, as it annually calls on governments to step up climate action in case emission targets are not on track to be met.

With regard to the output-oriented dimension of CPI, both the UK CCA and the Swedish Climate Policy Framework establish regular intervals for statutory government reporting as well as monitoring by independent advisory bodies, i.e. the CCC in the UK and the CPC in Sweden. In general, it can be argued that the carrying out of these procedural obligations helps to keep climate change on the political agenda and thereby demand action from governments as well as respective sectors. Annual government reporting under the UK CCA is structured as a response to the recommendations given by the CCC in its annual report on progress, which means there is less scope for leaving blind spots or not addressing challenges in certain sectors. In contrast, the SCA foresees that governments first bring forward a climate report as

part of the annual budget bill and after that the CPC presents its annual assessment report without any further government response. In this regard, government reporting under the UK CCA seems better equipped to comprehensively hold governments and respective sectors accountable. Overall, monitoring activities of both the UK CCC and the Swedish CPC generally support the facilitation of climate policy across sectors, e.g. by identifying shortcomings as well as opportunities of respective sectors for emission reductions. However, the Swedish CPC emphasizes that it has to focus its assessments on the most critical issues due to limited capacities and resources. It can be argued that this approach does not adequately respond to the urgency and comprehensiveness of the climate problem. In comparison, the UK CCC's annual assessments clearly provide a more comprehensive analysis of policies across different sectors and thus have greater potential to guide sector policy-making towards decarbonization. In Sweden, the CPC is further tasked to present an ex-ante assessment of the government's policy plan every four years, which allows for identifying shortcomings of policy plans early on. In general, the added value of such ex-ante assessments remains debatable if no further procedural steps are foreseen. Moreover, the CCC is also tasked to advise the government on key matters under the UK CCA, e.g. with regard to carbon budgets, which indicates that the act aims for scientifically informed decisions. Given that governments are required to publish a statement in case of deviation from the CCC's advice further fosters transparency and accountability. Both the UK CCA and the SCA provide parliament with a statutory mandate for supervising processes for government reporting, whereas parliamentary oversight for monitoring processes is only foreseen under the UK CCA. In Sweden, the CPC is subordinate to government, which reduces its independence as well as the credibility of its assessments and thereby also weakens its support function for facilitating climate policy across sectors. In addition, it was chosen to legally implement the Swedish CPC with an ordinance adopted by government, but not mention the council in the legislative text of the SCA. In general, this allows for less political control by the parliament and means that a future government can potentially abolish the Swedish CPC in case it disagrees with its mandate.

As a next step, general conclusions regarding strengths and limitations of CCAs are presented and thereafter an outlook on potential improvements of CCAs as well as on possible further research is given.

As has been elaborated in the beginning of this thesis, failing NMS possibly paved the way for a policy innovation of CCAs. Nonetheless, CCAs have a number of similarities with their NMS forerunners, i.e. both set quantitative emission reduction targets, both foresee policy planning processes and both establish cyclical reporting and monitoring on progress (Casado-Asensio and Steurer, 2016; Nash and Steurer, 2019). Despite these similarities with NMS, there are several strengths of CCAs that take them beyond their NMS forerunners, as also pointed out by Nash

and Steurer (2019). Most notably, CCAs are pieces of legislation that have been passed through parliaments, whereas NMS are non-binding strategies adopted by governments. Accordingly, the implementation of CCAs is subject to continuous parliamentary scrutiny, i.e. the setting or amendment of emission targets, the cyclical planning, reporting and monitoring processes as well as the establishment of independent advisory committees. Nonetheless, CCAs remain subject to political changes, which also means that they can be removed or weakened similar to any other legislation. However, this is more difficult and likely to attract more attention than the removal or weakening of NMS, because of the required parliamentary process. Similarly, emission targets contained in policy documents such as NMS are more vulnerable to be weakened or removed than those explicitly included in legislation such as CCAs. Moreover, CCAs set mandatory deadlines for cyclical policy planning as well as cyclical government reporting and as for the UK CCA deadlines for the continuous setting of carbon budgets are included as well. These procedural obligations clearly foster continuity in climate policy-making, which thus depends less on political will of governments. In addition, carrying out these procedural steps helps to keep climate change on the political agenda and thereby demand action from governments. CCAs further establish independent advisory committees and institutionalize monitoring activities at regular intervals, which fosters transparency and accountability of governments. Such independent advisory committees have a statutory mandate and are thus as difficult to abolish as CCAs themselves.

Turning to limitations of CCAs, it is important to note that CCAs do not regulate government's internal collaboration, but rather focus on communication and distribution of responsibilities between government and parliament. It follows that the extent to which climate policy efforts are integrated in relevant policy areas clearly depends on the willingness of government sectors to collaborate with each other and link their sectoral planning to the process of the CCA. Ultimately, it is left to different sectors of government to develop procedures for policy integration e.g. ex-ante assessments on climate impacts for sectoral policy decisions. Another limitation of CCAs are lacking sanctioning mechanisms, which means it is not clear what will happen in case emission targets are not met. Accordingly, CCAs rely largely on the creation of transparency, accountability and political pressure to ensure compliance by governments.

Moreover, complementing the factors for effectiveness of CCAs presented in Chapter 3, the following suggestions regarding potential improvements of CCAs can be made based on the findings of the comparative analysis in the scope of this thesis:

- Implementing procedures for the statutory consideration of advice given by independent advisory committees concerning the setting or amendment of emission targets, allows governments to take scientifically-informed decisions and

could make it politically less viable for governments to set insufficient targets or lower existing targets.

- Introducing sectoral targets in order to break down the overall commitment for emission reductions to the sectoral level, could provide a point of reference to sectors for stepping up climate action and strengthens in particular the accountability of sectors where emission reductions are usually more difficult to achieve.
- Setting out long-term, medium-term as well as short-term emission targets and establishing a linkage to cycles of policy planning, sets out a clear trajectory for emission reductions with both a view towards several decades ahead but also from one year to the next.
- Establishing requirements for ex-ante assessments of policy plans by independent advisory committees combined with a procedural obligation for the revision of insufficient policy plans, might allow for bridging ambition gaps early on.
- Scheduling annual government reporting as a response to annual monitoring by independent advisory committees, gives less scope for leaving blind spots or not addressing certain challenges and thereby strengthens transparency and accountability of governments.

As for possible future research, the comparative analysis of CCAs in the scope of this thesis was essentially focused on procedural aspects regarding the potential of CCAs for facilitating climate policy across sectors. However, in order to identify to what extent sector policy-making is effectively impacted by CCAs, sectoral policies must be examined in more detail. In addition, given that CCAs are lacking sanctioning mechanisms, a particular focus of future research should be put on analyzing possible procedural alternatives for effectively holding governments accountable and bridging implementation gaps in case of non-compliance. Ultimately, in order to better understand how CCAs in other countries aim to facilitate climate change mitigation across sectors, future research should analyze CCAs that have so far not been researched in great detail e.g. Austria, Denmark, Iceland and Norway.

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